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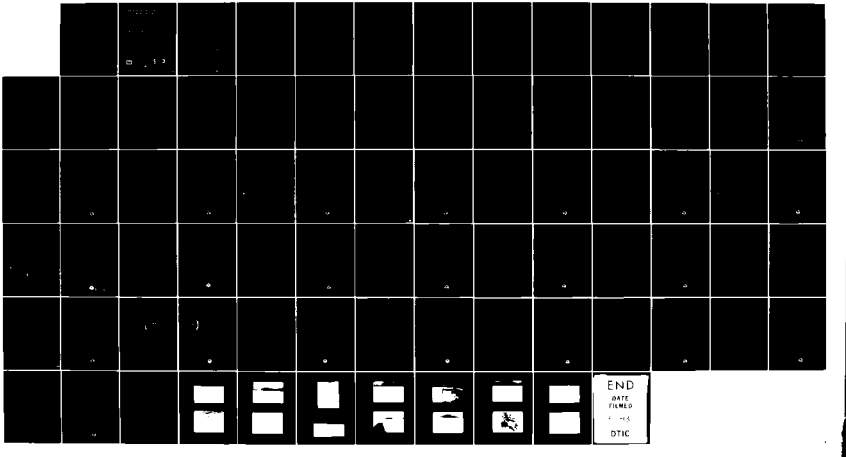

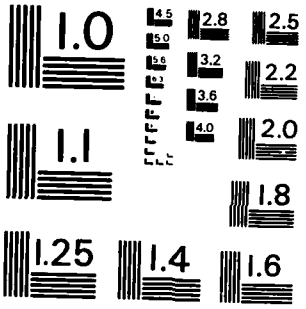

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EMBANKMENT CRITERIA AND PERFORMANCE REPORT

DECEMBER 1981

AD A123751

SALT CREEK AND TRIBUTARIES, NEBRASKA

SITE 10

YANKEE HILL DAM AND LAKE

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SALT CREEK AND TRIBUTARIES
YANKEE HILL DAM AND LAKE
SITE 10
DENTON, NEBRASKA

EMBANKMENT CRITERIA AND PERFORMANCE REPORT

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

SALT CREEK AND TRIBUTARIES, NEBRASKA
SITE NO. 10
YANKEE HILL DAM AND LAKE
EMBANKMENT CRITERIA AND PERFORMANCE REPORT

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SALT CREEK AND TRIBUTARIES, NEBRASKA
SITE NO. 10
YANKEE HILL DAM AND LAKE

EMBANKMENT CRITERIA AND PERFORMANCE REPORT

Pertinent Data

1. **Drainage Area** — 8.4 square miles

2. **Reservoir Data**

Reservoir Level	Elevation (Ft., m.s.l.)	Gross Storage Capacity (Acre-Feet) Initial	Gross Storage Capacity (Acre-Feet) 100-year	Surface Area (Acres)
Maximum Pool	1267.8	10,300	8,866	600
Full Flood Control Pool	1262.0	7,500	6,066	525
Normal Operating Pool	1245.0	2,000	900	208
Sediment Storage Capacity	—	1,434	—	208

3. **Embankment**

Type	Homogeneous, Rolled Earth
Maximum Height above Streambed	60 Feet
Height above Valley Floor	45 Feet
Crest Elevation	1270.0 Feet m.s.l.
Crest Width	15 Feet
Crest Length	3100± Feet
Slopes: Upstream and Downstream	1V on 3H, Above El. 1247.0 1V on 4H, Below El. 1247.0
Compacted Fill Quantities	502,000 C.Y.
Slope Protection	Grassed
Wave Erosion Protection	Riprap
Downstream Seepage Control	Pervious Chimney Drain w/Intermittent Outlets

4. **Emergency Spillway**

Type	Uncontrolled Grassed Earth Channel
Crest Elevation	1262.0 Feet m.s.l.
Width (Bottom)	400 Feet
Length	1100 Feet
Side Slopes	1V on 3H
Excavation Quantity	Approx. 224,000 C.Y.
Crest Length	200 Ft.

5. **Outlet Works**

Type Inlet	Concrete Drop
Low Level Gated Opening El.	1237.0 m.s.l.
Gate Size and Type	1 - 3' X 3' Slide w/Hand Operated Lift
Low Level Outlet (Perm. Pool)	1245.0 m.s.l.
No. Perm. Pool Openings and Size	2 - 1' X 2.5'
High Level Outlet (Norm. Flood Pool) El.	1250.0 m.s.l.
No. High Level Openings and Size	2 - 1.4' X 5.25'
Conduit Type, Size and Length	1 - 42" Ø CMP X 300' Long
Seepage Control	3 Seepage Diaphragms
Invert Elevation at Intake	1227.5 Feet m.s.l.
Invert Elevation at Outlet End	1218.0 Feet m.s.l.
Stilling Basin	None

6. **Outlet Channel**

Width (Bottom)	10 Feet
Length	800 Feet
Side Slopes	1V on 3H
Discharge Capacity	540 c.f.s.

7. **Downstream Discharge.** The maximum discharge downstream from the reservoir is 176 c.f.s. for the Reservoir Design Flood (maximum pool elevation 1262.0 feet m.s.l.) which is well within the bankfull capacity of 540 c.f.s. In the event of a probable maximum flood occurrence, the maximum outflow would be 12,200 c.f.s. for a maximum pool elevation of 1267.8 and would exceed the downstream capacity for a period of several days.

8. **References.** For additional information and description on the construction background and operational data and procedures regarding this dam and lake, reference is made to the "Yankee Hill Dam and Reservoir Site 10, Operation and Maintenance Manual," dated September 1969; "Design Memorandum No. MSC-18, Dam and Reservoir Site 10," dated May 1964; and the "Periodic Inspection Reports No. 1 and 2," dated April 1974, and October 1979, respectively.

APPENDIX A - DRAWINGS

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A4	Embankment - Plan and Excavation
A5	Embankment - Profile, Sections and Details
A6	Embankment - Drain Profile and Sections
A7	Boring Legend and Record of Borings - Borrow Area
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A18	Embankment Movement Inserts, Horizontal and Vertical Movement
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A20	Piezometer Installation and Water Stage Recorder
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NOTE: Many of the Plates used are the original Construction Plates and contain notes referring to the construction of the dam.

APPENDIX B - PHOTOGRAPHS

Photo No.	Description
1.	Aerial Photograph 1a and *1b.
2.	View of downstream embankment slope from right abutment.
3.	View of upstream embankment slope from right abutment.
*4.	View of Upstream embankment slope from right abutment.
5.	View of upstream end of emergency spillway channel.
6.	View across spillway channel from left cut slope side.
7.	View of embankment crest road, gagehouse, intake structure, and downstream slope from the southeastern end of the embankment.
8.	View of intake tower structure and surrounding riprap.
*9.	View of intake tower.
*10.	View from crest of dam of outlet end of discharge conduit and downstream channel.
*11.	View of outlet end of discharge conduit.
12.	View of outlet end of discharge conduit and plunge pool.
13.	View of upstream slope riprap protection and rock berm.

* NOTE: These photographs were taken 12 October 1973, (pool el. 1251.7), one day after the highest pool elevation in the history of Site 10 was recorded. Pool elevation on 11 October 1973 was 1252.66, approximately 7.7 feet above normal operating pool.

SALT CREEK AND TRIBUTARIES, NEBRASKA
SITE NO. 10
YANKEE HILL DAM AND LAKE

EMBANKMENT CRITERIA AND PERFORMANCE REPORT

1. INTRODUCTION.

1.1. **Purpose of Report.** This report provides a summary record of significant design, construction, and operational data on Yankee Hill Dam for use by engineers to familiarize themselves with the project, re-evaluate the embankment when unsatisfactory performance occurs, and provide guidance for designing comparable future projects. It was prepared in accordance with MRD-R 1110-1-8, subject: "Construction Foundation Reports and Embankment Criteria and Performance Reports," dated 27 February 1978 and ER 1110-2-1901, subject: "Embankment Criteria and Performance Reports," dated 1 August 1972.

1.2. **Authorization and Purpose of Project.** Public Law 85-500, 85th Congress, commonly referred to as the "Flood Control Act of 1958" authorized construction of the Salt Creek projects. It authorized construction of a flood control project on Salt Creek and Tributaries, Nebraska, essentially in accordance with the report of the Chief of Engineers contained in House Document 396, 84th Congress, 2nd Session. Yankee Hill Dam is one of the features of the authorized project. It is a part of the flood control system for the city of Lincoln and vicinity, and also provides a permanent lake for development of public recreation and for fish and wildlife conservation by the Nebraska Game and Parks Commission.

1.3. **Location and Description of Project.** Yankee Hill Dam is located in Lancaster County in the southeastern part of the State of Nebraska. It dams the Cardwell Branch, a tributary of Salt Creek, approximately 3-1/2 miles east and 1/2 mile south of Denton, Nebraska. ~~See Plate~~ A1. The project consists primarily of an earth embankment, a grassed emergency spillway, and an outlet works. Plates A2, A3 and A4 show the general location and main features of the dam. An aerial view of the completed project is shown in Photo 1, Appendix B. Yankee Hill Dam is one of ten Salt Creek dams designed and constructed by the Corps of Engineers.

1.4. **Project Maintenance.** Major repairs of the embankment, spillway, outlet works and channel are the responsibility of the Corps of Engineers. The State Game and Parks Commission is responsible for routine maintenance, such as repair of minor slope erosion, control of burrowing animals, and maintenance of grass cover. The State is also responsible for maintaining and operating the permanent pool for fish and wildlife conservation and for recreational purposes. Since 1980, Ft. Crook Area Forces have been conducting monthly inspections of the dam. In-depth periodic inspections as well as periodic surveys and reading of instrumentation facilities are conducted by the Corps of Engineers.

1.5. **History of Project Design.**

1.5.1. **Survey Report.** The initial recommendations for construction of a system of dams on tributaries of the Salt Creek were made in the "Survey Report on Flood Control for Salt Creek and its Tributaries, Nebraska and its Supplements," dated January 1953. This report formed the basis for Congressional authorization.

1.5.2. **General Design.** In December 1960, the "General Design Memorandum," No. MSC 1, was submitted to higher authority. The report updated the survey report in terms of economic feasibility and provided an overall general design of the multi-dam Salt Creek Project.

1.5.3. **Final Design.** Final design of Yankee Hill Dam (Site 10) is covered in Design Memorandum MSC-18, "Dam and Reservoir Site 10," May 1964. This report covers the design of all features pertinent to the project, which included an earthfill embankment, an emergency spillway, outlet works, and the necessary bridge, road and utility alterations.

1.6. **History of Project Construction.** Yankee Hill Dam (Site No. 10) was constructed by contract, under the supervision of the Corps of Engineers, Omaha District. The job was advertised on 5 March 1965 and the bids were opened on 13 April 1965. Scott Construction Company of Hickman, Nebraska was awarded the contract and given notice to proceed on 30 April 1965 with 220 calendar days to complete the project. The contract (No. 65/319) cost was

$182,000 which was $68,000 below the engineer's estimate. The project was completed on 30 November 1965. No unusual construction problems were encountered.

2. **GEOLOGY.** The Salt Creek drainage basin is located primarily in Lancaster County in eastern Nebraska and lies entirely within the Dissected Till Plains Section of the Central Lowlands Physiographic Province. Pleistocene deposits of glacial, interglacial and eolian origin overlie bedrock, which is at a maximum depth of over 200 feet, although in some localized areas the bedrock occurs at relatively shallow depths. Bedrock under the greater portion of the basin is the Dakota Group sandstone and shales of Cretaceous age, with some Permian limestone and shales in the southeastern portion of the basin and Pennsylvanian limestone and shales in the northeastern portion of Lancaster County. In this general area a typical section of the Pleistocene deposits in descending order are as follows: Peorian Loess Formation, Loveland (loess-clay) Formation, Kansan Glacial Drift, Aftonian (interglacial) Formation, and the Nebraskan Glacial Drift. In general, the Salt Creek basin is an eroded and dissected till plain which was covered by two eolian deposits, the Loveland (loess-clay) Formation and the Peorian Loess Formation. Post-Loveland erosion removed most of the Loveland and the remaining Loveland was subsequently covered by younger Peorian Loess. In many places, especially in the western half of the basin, all the loess, both the Loveland and Peorian, was removed by erosion exposing the underlying glacial drift. In a few local areas, notably in the eastern part of Seward County, southcentral ahd northeastern part of Lancaster County, and southeastern part of Saunders County, all of the Pleistocene deposits have been removed by erosion exposing the underlying bedrock.

3. **FOUNDATION INVESTIGATION.**

3.1. **Subsurface Exploration.** A total of 16 borings and 9 hand-augered holes were drilled to determine soil characteristics for general and specific design studies of this site. These consisted of 8 borings made along the alignment of the dam axis, 4 borings within the proposed spillway area, and

4 borings and 9 hand-augered holes within the proposed borrow areas. The locations of the drill holes are shown on Plate A4. Representative disturbed jar and moisture samples were taken from each boring at every change of material and at intervals not greater than five feet in depth. Representative undisturbed Shelby samples of foundation materials underlying the flood plain were obtained from holes 5, 6, 7, and 8. Standard penetration tests were performed during drilling operations for holes 6 and 7, with penetration values of the cohesive material ranging from a low of 5 to a high of 18 blows per foot. Sack samples were obtained of representative material from the spillway and borrow area holes and undisturbed samples of loess were obtained from abutment holes 3 and 4. Boring logs showing pertinent field and laboratory classification data are presented in profile on Plates A7 and A8. All samples were shipped to the Corps of Engineers, Missouri River Division Laboratory in Omaha, Nebraska for testing.

3.2. **Foundation Conditions.** The embankment in the valley is founded on alluvial and glacial drift material deposited in the underlying Dakota Formation. In and near the abutments, the embankment bears variously upon soils of the Peorian and Loveland loess, Kansan Glacial Drift and weathered and unweathered Dakota. The valley alluvium has a maximum thickness of about 30 feet and consists predominantly of lean, silty and sand clays (CL). The clays above the water level were medium stiff to stiff with moisture contents ranging from 12 to 31 percent. The clays below the water level were soft to medium stiff and moisture contents were generally near the liquid limit. Some coarser grained alluvium existed below the water level. This material consisted of loose to dense clayey sands (SC), silty sands (SM), gravelly sands (SW-SM), and sand (SP-SM). Liquid limits of the alluvial clays generally varied from 30 to 43 and plastic limits varied from 8 to 21.

The Peorian and Loveland loess in the abutments generally was medium stiff to stiff, lean or sandy clays (CL) and fat clays (CH) and had depths of up to 25 feet within the embankment area. The glacial till consisted predominately of stiff clays (CL), (CH) and medium dense sands, (SP), (SM), (SC-SM), and (SC) with depths of up to 45 feet.

4. **FOUNDATION PREPARATION.** Foundation preparation consisted of clearing, grubbing, and stripping the area of the embankment, stripping the spillway area, and clearing selected areas of the reservoir. After stripping, the embankment foundation area was scarified, then compacted with a sheepsfoot roller.

5. **EMBANKMENT.** A discussion on the design and construction features of the embankment is presented. It includes a description of the embankment section, embankment materials, settlement, stability analyses, seepage control, and procedures followed in constructing the embankment.

5.1. **General.** The embankment is a rolled, homogeneous, impervious earthfill dam. It has a volume of approximately 502,000 cubic yards of compacted fill. The source of the fill for the embankment was spillway and borrow excavation. As-built drawings and photographs of the project are included in Appendices A and B respectively.

5.2. **Embankment Section.** Embankment sections and details are shown on Plates A5 and A6. The upstream and downstream embankment slopes are symmetrical being 1V on 3H above elevation 1247.0 and 1V on 4H below. The embankment is approximately 3100 feet long with a maximum height of 45 feet above the valley floor and 60 feet above the streambed. The crest is 15 feet wide with a top elevation of 1270.0 m.s.l. Slope protection of 18 inches of riprap over a 6 inch layer of filter blanket, extending 2 feet above and 4 feet below the permanent pool elevation was provided for the upstream embankment. Seeding was provided for other embankment and cut slopes. The completed embankment slopes are shown in Photos Nos. 2, 3, and 4.

5.3. **Embankment Materials.**

5.3.1. **Earthfill.** The embankment was constructed of material excavated from the spillway and borrow areas. Approximately one-half of the excavated material used in construction was loess, with the remainder being glacial drift and alluvium. These soils were generally lean to sandy clays (CL).

5.3.2. **Riprap and Bedding.** Wave action on the upstream face of the dam is dissipated on 18 inches of riprap placed on 6 inches of bedding. The riprap used was a quarried limestone, and specifications required it to be free from thin slabby pieces and to be reasonably well graded between the following limits:

Weight per Stone	Percent of Total Weight Lighter Than or Passing
320 lbs.	100
110 lbs.	35-60
3 inch screen	5-15

The six-inch bedding layers used beneath the riprap was required to be reasonably well graded within the following limits:

Sieve Size	Percent by Weight Passing
3/4"	100
No. 4	75-95
No. 16	45-70
No. 200	0-5

5.4. **Slope Protection Placement.**

5.4.1. **Bedding.** The specifications required that the 6-inch thick bedding material be placed in a manner that would prevent segregation of particle sizes. Compaction of the layer was not required, but it was to be finished to present a reasonably even surface. The average thickness was to be within a tolerance of plus or minus 1-inch from the thickness required and measured within areas not exceeding 100 square feet.

5.4.2. **Riprap.** Riprap stone was placed on the bedding layer so as to produce a reasonably well graded mass of rock with a minimum of voids. A tolerance of plus or minus 4-inches from the required slope lines and grades was allowed, except that either extremes of such tolerance was not continuous over an area greater than 200 square feet. The riprap was placed to its full thickness in one operation in such a manner as to avoid displacing bedding material. The desired distribution of stones throughout

the mass was obtained by selective loading at the quarry site and by controlled dumping. All stone was required to be placed by either a clam, orange peel or skip box. Dumping the stones at the top of the slopes and rolling or pushing the stones into place was not permitted. See Plates A4 and A9 for riprap sections and placement details.

5.5. Embankment Placement.

5.5.1. General. Specifications required that the gradation and distribution of materials throughout the earthfill section of the dam be such that the embankment be free from lenses, pockets, streaks, and layers of material differing substantially in texture or gradation from surrounding material.

5.5.2. Compacted Embankment Fill. The more impervious materials were placed toward the upstream section of the embankment and the more pervious materials were placed toward the downstream section of the embankment to affect a transition in permeability from the upstream to the downstream faces of the embankment. Specifications required that fill material be placed in nearly horizontal layers not exceeding 6 inches in thickness after compaction, and having a moisture content ranging from 2 percent above optimum to 4 percent below optimum. The top of the fill was required to be crowned with a 5 percent grade to insure good drainage during the construction period. Before compaction, each layer of fill was required to be harrowed if needed, to break up and blend materials and to obtain uniform moisture content. If one pass of the harrow did not break up or blend the materials sufficiently, additional passes were necessary, but no more than three passes were required to be performed. There were no specific number of passes of roller equipment required, but each layer was to be compacted to at least 95 percent of the maximum density as determined by the Standard AASHO method, T99, Method D. Portions of the fill which could not be compacted with rollers because of space restrictions were placed in four-inch loose lift layers and compacted with power tampers to the same degree of compaction as that obtained on other portions of the fill performed by rolling.

5.6. **Embankment Settlement.** The maximum computed foundation settlement at the embankment centerline was 1.4 feet. This was determined by considering a maximum embankment section of 45 feet in height to bear on 40 feet of compressible valley alluvium. Time studies indicated that approximately 45 percent of the consolidation would occur during construction and the remaining settlement would occur at a diminishing rate over an indefinite period. To allow for the continuing settlement the embankment was constructed with a 1-foot overbuild at the center of the valley section, tapering to zero at the ends of the embankment.

Foundation settlement gauges were not installed at this dam. Very minor settlement is assumed to have occurred since 1974, although surveys in 1976 and 1979 of surface movement markers show erratic vertical movements on some markers. These markers were assumed to be affected by frost action and therefore unstable. For more information about the movement markers, see Section 8.2 in this report.

5.7. **Embankment Stability.**

5.7.1. **Shear Tests on Undisturbed Materials.** Five unconfined compression tests were taken from the foundation lean clay material. The breaking strengths varied from 0.61 to 1.39 T/sq. ft., with an average breaking strength of 1.08 T/sq. ft., indicating an average shear strength value in terms of cohesion of 0.54 T/sq. ft. Two tests were also performed on samples of remolded embankment material. The breaking strengths varied from 1.41 to 1.58 T/sq. ft., average breaking strength of 1.5 T/sq. ft., and average cohesion of 0.75 T/sq. ft. The results of the tests are shown on Plates A11 and A14.

Ten series of triaxial compression tests were performed on undisturbed samples of foundation material and remolded samples of embankment material. These tests consisted of 5 series of unconsolidated-undrained (Q) tests, 2 series of consolidated-undrained (R) tests with pore pressures measured, and 3 series of consolidated-undrained (R) tests without pore pressures measured. The results of the tests are shown on Plates A11, A12, and A13.

5.7.2. **Shear Tests on Remolded Material.** Seven series of direct shear tests were performed on remolded embankment material and undisturbed foundation material. In the foundation the strengths varied from tan ϕ = 0.52 for stiff, moist, lean clay, to tan ϕ = 0.76 for soft, wet, sandy clay. For the embankment tan ϕ was equal to 0.50 for both lean and sandy clay. Note that these strengths are the maximum shear strength values.

5.7.3. **Adopted Shear Strengths.** The adopted shear strength values used in stability computations were as follows:

Material	Unconsolidated Undrained (Q) Strength		Consolidated Undrained (R) Strength		Consolidated Drained (S) Strength	
	Tan ϕ	Coh.	Tan ϕ	Coh.	Tan ϕ	Coh.
Embankment	0.07	0.90	0.23	0.23	0.50	0
Fnd. Stratum "A"	0	1.68	0.26	0.80	0.58	0
Fnd. Stratum "B"	0	0.65	0.21	0.25	0.76	0
Fnd. Stratum "C"	0	2.00	0.15	1.34	0.60	0

5.7.4. **Results of Stability Analysis.**

5.7.4.1. **Design Cases.** Embankment stability analyses were performed for the end of construction, steady seepage, partial pool, and sudden drawdown cases. The method referred to was the circular arc analysis-finite slices, outlined in EM 1110-2-1902, Appendix III, dated 27 December 1960. The analyses were performed on the RCA 301 electronic computer using the 1116 series slope stability program. This program had been used on three previous jobs and was considered completely valid and in agreement with EM 1110-2-1902 procedures current at that time. Shear strength parameters used in the stability computations were determined from a composite of all available field and laboratory observations and tests. Typical sections and stability analyses are shown on Plate A10.

5.7.4.2. **End of Construction.** This case was analyzed on the assumption that the strength of the embankment and foundation was that available with instantaneous construction of the embankment ("Q" Strength Values). The water level was assumed at the ground surface.

5.7.4.3. **Steady Seepage.** The downstream slope was studied for the case of a sloping seepage line from conservation pool to tailwater. The "R" and "S" shear strength were used in separate studies to bracket the range of safety factors.

5.7.4.4. **Sudden Drawdown.** The sudden drawdown condition was performed assuming that instantaneous drawdown occurred from maximum pool to conservation pool. Since the factor of safety was much higher than required and as this is the more critical case, the case of drawdown from the spillway crest was not performed.

5.7.4.5. **Partial Pool.** The usptream embankment slope was designed for the condition of saturation at the most critical pool elevation. The saturation line at each pool level was assumed horizontal and the factor of safety was based on "R" shear strength values. A pool elevation of 1245.0 was determined to be the most critical.

5.7.4.6. **Earthquake.** Although this is a location with minor earthquake history, the factors of safety for this condition were computed and are listed on the stability plates. The static method of analysis was used with a 0.05 seismic coefficient.

5.7.4.7. **Summary.** All factors of safety for each case studied were greater than that required and are tabulated below:

Case	Shear Strength	Safety Factor Computed	Safety Factor Required	Safety Factor with Earthquake Computed	Safety Factor with Earthquake Required
End of Construction	Q	3.57	1.3	2.86	1.0
Steady Seepage	R	1.82	1.5	1.50	1.0
Steady Seepage	S	1.81	1.5	1.44	1.0
Sudden Drawdown	R	1.45	1.0	NA	NA
Partial Pool	R	1.70 (Min)	1.5	1.38	1.0

5.8. Seepage Control.

5.8.1. **Embankment Seepage.** Seepage through the embankment was considered a minor problem due to the relatively low permanent pool, the short durations of higher pools, and the relatively impervious nature of the

embankment fill. To control seepage which might occur, a vertical, pervious embankment seepage control drain with outlets was provided near the downstream toe of the embankment. See drawings on Plates A4, A5, and A6. To further control seepage through the embankment the more impervious materials encountered in the required excavations were placed in the upstream portion of the embankment.

5.8.2. **Foundation Seepage.** Underseepage through the foundation was not considered critical as the drillings did not disclose any continuous pervious layers, and as the few, thin pervious lenses were encountered they were covered with a thick impervious blanket.

5.9. **Diversion and Closure.** Plate A4 shows the location of the diversion channel, ditch, and plugs which were required to divert the flow through the embankment area. Typical diversion channel and ditch sections are shown on Plate A5.

Prior to the starting of closure operations for the embankment, the Contractor was required to complete all channel excavations, outlet works structure, and the embankment both right and left of the closure section to a minimum elevation of 1253.0. The closure operations were to begin no earlier than 1 August 1965 at a time when the weather and preparatory construction was right, and with the approval of the Contracting Officer. Details of the closure and date are not known.

6. **EMERGENCY SPILLWAY.** The emergency spillway is an uncontrolled, grassed, earth channel. It is located 300 feet left of the left abutment of the dam. The channel is 400 feet wide with 1V on 3H slopes. The channel crest at the upstream end is flat for 200 feet at elevation 1262.0. The bed slope downstream of the crest is 0.2 percent for 900 feet. The next 1450 feet downstream of the spillway is graded in such a manner as to direct flow from the spillway toward the existing channel downstream of the embankment. The bottom and side slopes of the channel are protected by a grass cover. An excavation quantity of approximately 224,000 cubic yards was required in the construction of the spillway channel. See drawing on Plate A3, and Photos Nos. 5 and 6.

7. **OUTLET WORKS.** The outlet works consist of a concrete drop inlet structure and a 300 foot long 42-inch CMP conduit. The drop inlet has openings at 3 levels; a low level gated opening at elevation 1237.0, two permanent pool openings at elevation 1245.0, and two 35-year flood openings at elevation 1250.0. The low level opening is 36" X 36" in size and controlled by a manually operated slide gate from the top of the cover plate. The cover plate extends 3.5 feet beyond the side of the shaft to serve as an anti-vortex device. The purpose of the gated outlet is to lower the level of the conservation pool in order to inspect the conduits, make shoreline repairs, and control the fish population. It may also be used to lower the flood pools more rapidly after the pool level has dropped to elevation 1250.0, thus minimizing interruptions to recreation facilities just above the conservation pool. The ungated openings are protected with metal pipe trash racks. See Plate 15 and Photos Nos. 8 and 9 for details and views of the outlet works structure.

Since its installation the 42-inch CMP has been lined with a 30-inch RCP as outlined in Phase IV-Outlet Works Rehabilitation, Salt Creek Dams and Lakes. See plates A15 and A16. The discharge end of the conduit is extended on a pile trestle far beyond the downstream toe of the embankment. An outlet channel extends downstream from the conduit end to the original creek channel. An excavation quantity of about 16,000 cubic yards was required in the construction of this channel. Photos Nos. 10, 11, and 12 show the main features of the discharge end of the conduit and outlet channel.

8. **INSTRUMENTATION.**

8.1. General. The instrumentation of the dam consist of 6 surface movement markers in the embankment (See Plate A17), 4 movement insert markers in the outlet works, and 3 piezometers. No settlement gauges or relief wells were ever installed at this dam site.

8.2. **Embankment.** Six surface movement markers were installed during the final construction of the dam in 1965 along the downstream edge of the crest. Since the 1974 Periodic Inspection, three horizontal and vertical movement surveys have been conducted. They were in 1976, 1977 and 1979. Plots of the surveys indicate a fairly small and uniform downstream

horizontal movement, whereas erratic vertical movements were recorded. Since no other indications of excessive vertical movement of the embankment was evident, the affect of frost action on the markers was blamed for the erratic readings. Movement of the embankment at this time is considered negligible; therefore, only markers which had been destroyed were replaced.

8.3. **Outlet Works.** Four movement inserts markers are located in the top of the concrete intake structure as shown on Plate A19. Vertical movement surveys of the intake structure have been conducted three times since the February 1974 surveys and the 1974 Periodic Inspection. They were in December 1974, December 1976 and October 1979. As seen on the movement vs. time plots on Plate A19, large amounts of rebound and settlement were recorded which do not seem very reasonable. It is suspicioned that the reference benchmarks may have been damaged by frost action, maintenance operations, or vandalism.

8.4. **Piezometers.** Three piezometers were installed in June of 1981. Their locations and descriptions are shown on Plate A20. No readings had been taken prior to the writing of this report.

9. OPERATIONAL HISTORY AND PERFORMANCE.

9.1. **Operation and Maintenance Procedures.** The Secretary of the Army granted to the State of Nebraska Game and Parks Commission, a license to use and occupy the land and water areas of the project for public recreation purposes. For consideration of the privileges granted, the State is required to maintain the project in a manner acceptable to the District Engineer. In general, this requires routine maintenance. Any major repairs to either the embankment, outlet works, or spillway is accomplished by the Corps of Engineers.

9.2. **Inspections.** Since 1980, Ft. Crook Area Forces have been conducting monthly inspections of all Salt Creek Dams. These reports include a complete visual inspection of all features of the dams. Also included are piezometer readings. In addition to the monthly inspections, in-depth periodic inspections are conducted at 5 year intervals in accordance with

ER 1110-2-100, "Periodic Inspections and Continuing Evaluation of Completed Civil Works Projects." These periodic inspections are made jointly by representatives of the Operations and Engineering Divisions of the Omaha District Corps of Engineers, and by representatives of the Missouri River Division Office. Periodic inspections for Yankee Hill Dam were made in April 1974, and in October 1979. They are reported in Periodic Inspection Reports No. 1 and No. 2 respectively. These reports include the results of the inspection, evaluation of the embankment, and structural performance based on the inspection and instrumentation observations.

9.3. **Reservoir Levels.** Reservoir elevations are determined by a reservoir stage recorder. See Plates A20 and A22. The instrument records the reservoir level in digital format on paper tape at 15 minute intervals. It is a bubbler-type installation whereby the stage is determined by the hydrostatic pressure required to force nitrogen gas out of a submerged orifice. Additional verification of these readings are determined periodically from a staff gauge located near the intake of the outlet structure. The highest reservoir level on record occured on 11 October 1973 when it reached El. 1252.66 feet above mean sea level, about 7.7 feet above the normal operating pool of El. 1245.0. Photos Nos. 4, 9, 10, and 11 show the intake structure and outlet conduit during this period. Since then, the highest pool elevation was 1246.3 in March 1979. A plot of the reservoir elevations can be seen on Plate A21.

9.4. **Significant Operational Events.**

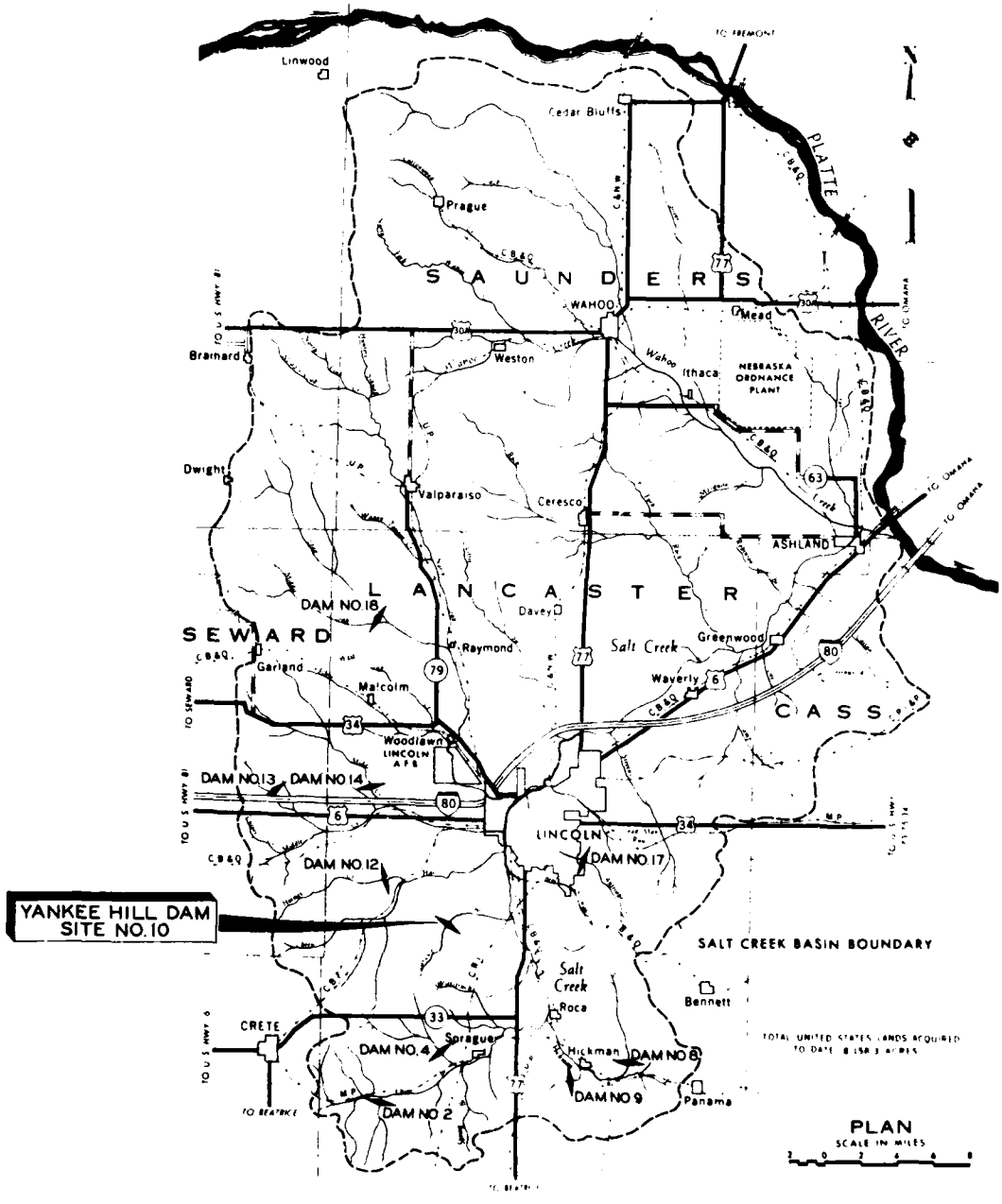
9.4.1. **Riprap.** In the Periodic Inspection Report No. 1, April 1974, it was recommended that a service or access berm be constructed on Salt Creek Dams just above the riprapped area. This would provide for more efficient and less costly maintenance, and for more efficient inspection of the riprap slope protection. In 1975-1977 a rock berm, surfaced with crushed rock was constructed at Yankee Hill Dam by Ft. Crook Area Forces along the upstream embankment slope at the top of the riprap. See Photos No. 8 and 13. Also, in 1978 a 250 ton stockpile of riprap was placed at the right abutment to provide for an on-site source of riprap for emergency repairs.

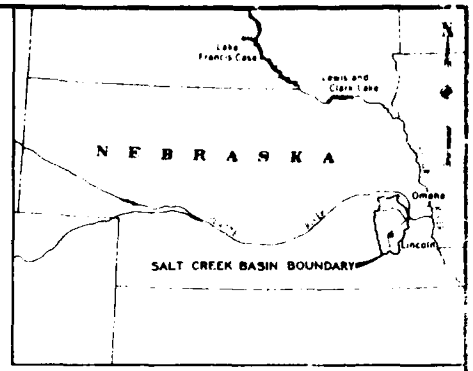
9.4.2. **Repair of Outlet Works.** During the first periodic inspection of the project in April 1974, small amounts of seepage were found in about 30 percent of the field joints of the conduit. The areas of leakage were located on one or both sides of the pipe and generally from about the area of springline down through the invert area. Subsequently, during the fall of 1977 to the spring of 1978, grouting of the CMP discharge conduit, reshaping the plunge pool, and downstream channel cleanout was performed under Phase I of a comprehensive "Outlet Works Rehabilitation" project scheduled for the Salt Creek Dams.

Additional rehabilitative measures were accomplished on the outlet conduit in 1980. Because of a general deterioration of the asphalt lining, leaking joints, and corrosion at this project and similar projects; a contract was let on 26 February 1980 to install a precast concrete pipe lining inside the existing corrugated metal pipes. This was completed under Phase IV - Outlet Works Rehabilitation, Salt Creek Dams and Lakes. The contract was awarded to Dobson Brothers Construction Company, Lincoln, Nebraska under contract No. 80-C-0151.

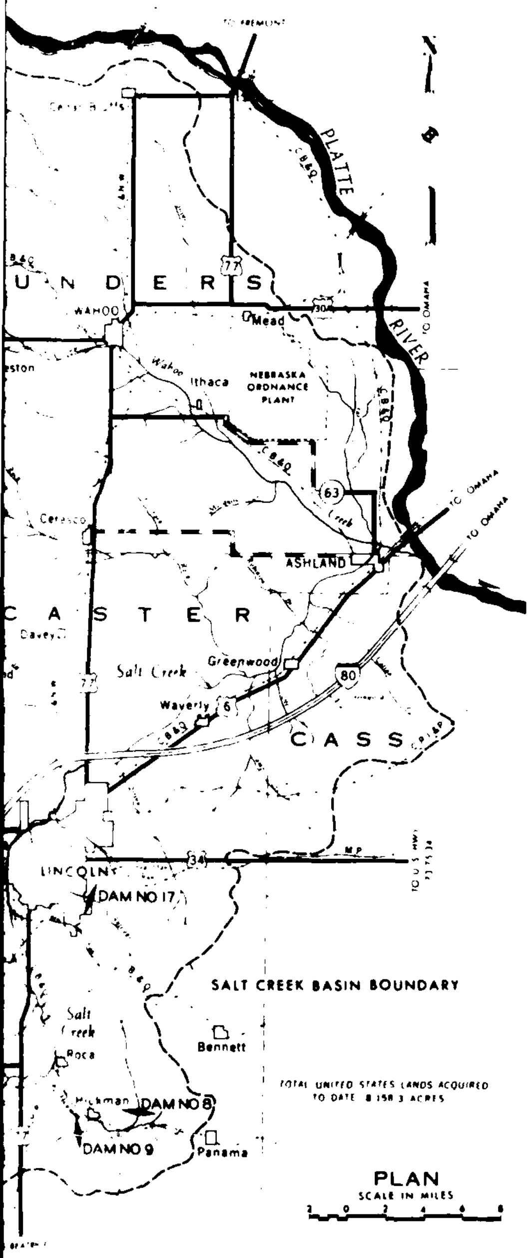
10. **EVALUATION.** The Yankee Hill Dam and appurtenant structures are in good condition. Since 1965, when the project was completed, inspections and evaluations of the instrumentation data has revealed no significant problems concerning the safety of the dam. The project is well maintained, and because of its relative close proximity to the Omaha District Offices, it can readily be inspected if potential problems develop. Maintenance problems which have developed, such as the deterioration of the conduit lining, generally are rectified before they turn into major problems which may subsequently affect the integrity of the dam.

APPENDIX A
DRAWINGS


Linwood
Cedar Bluffs
Prague
SAUNDERS
WAHOO
Mead
PLATTE RIVER
Brainard
Weston
Ithaca
NEBRASKA ORDNANCE PLANT
Dwight
Valparaiso
Ceresco
ASHLAND
LANCASTER
DAM NO.16
Davey
SEWARD
Raymond
Salt Creek
Greenwood
Garland
Malcolm
Waverly
CASS
Woodlawn
LINCOLN AFB
DAM NO.13
DAM NO.14
LINCOLN
DAM NO.17
DAM NO.12
YANKEE HILL DAM SITE NO.10
SALT CREEK BASIN BOUNDARY
Salt Creek
Roca
Bennett
CRETE
Sprague
DAM NO.4
Hickman
DAM NO.8
DAM NO.9
Panama
DAM NO.2
PLAN
SCALE IN MILES



LOCATION MAP



PLAN

SCALE IN MILES

DATE	DESCRIPTION	MADE	APPR'D

REVISIONS

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

SALT CREEK AND ITS TRIBUTARIES, NEBRASKA
YANKEE HILL DAM AND LAKE
SITE NO. 10

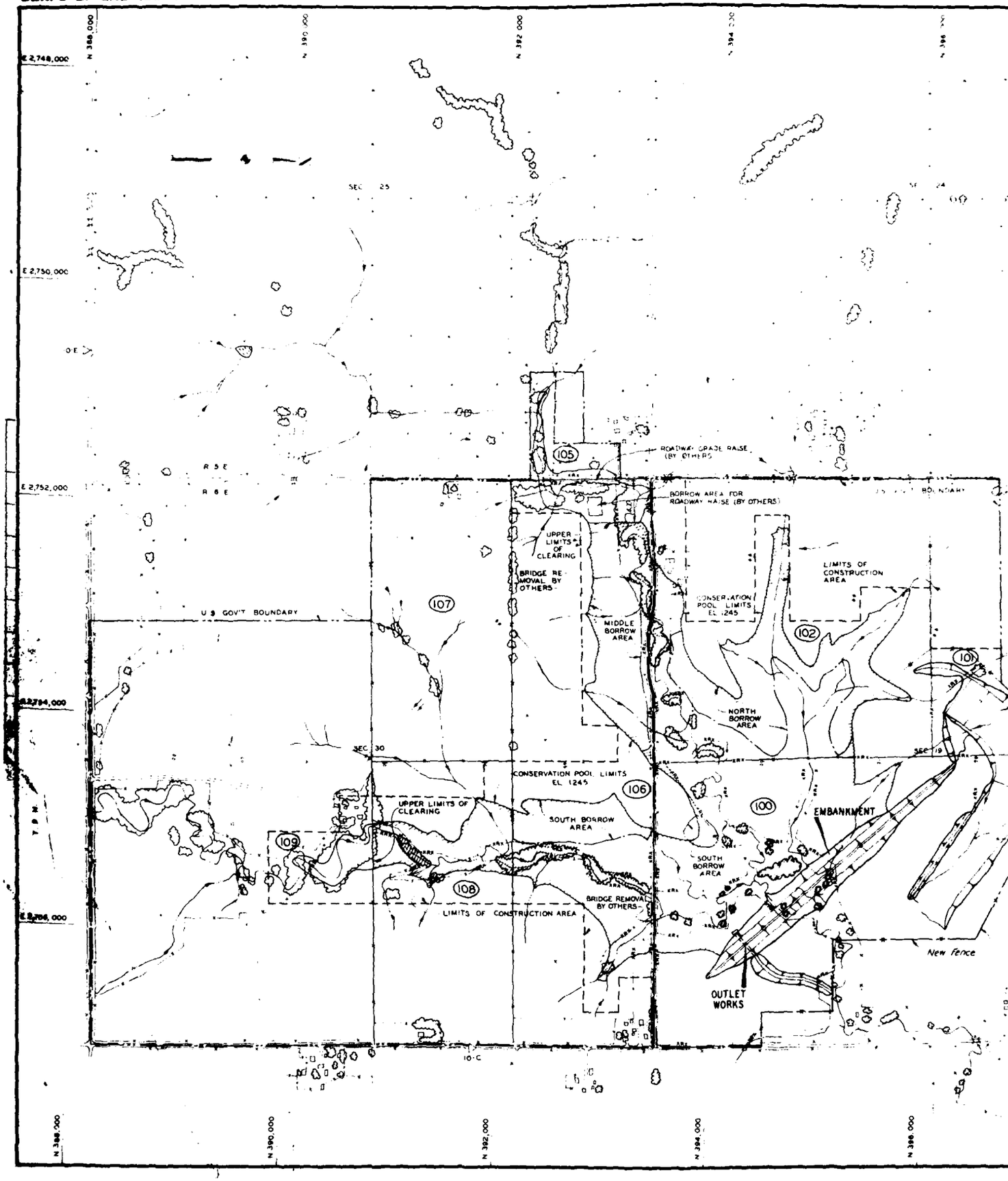
PROJECT LOCATION MAP

SCALE AS SHOWN
DACA45

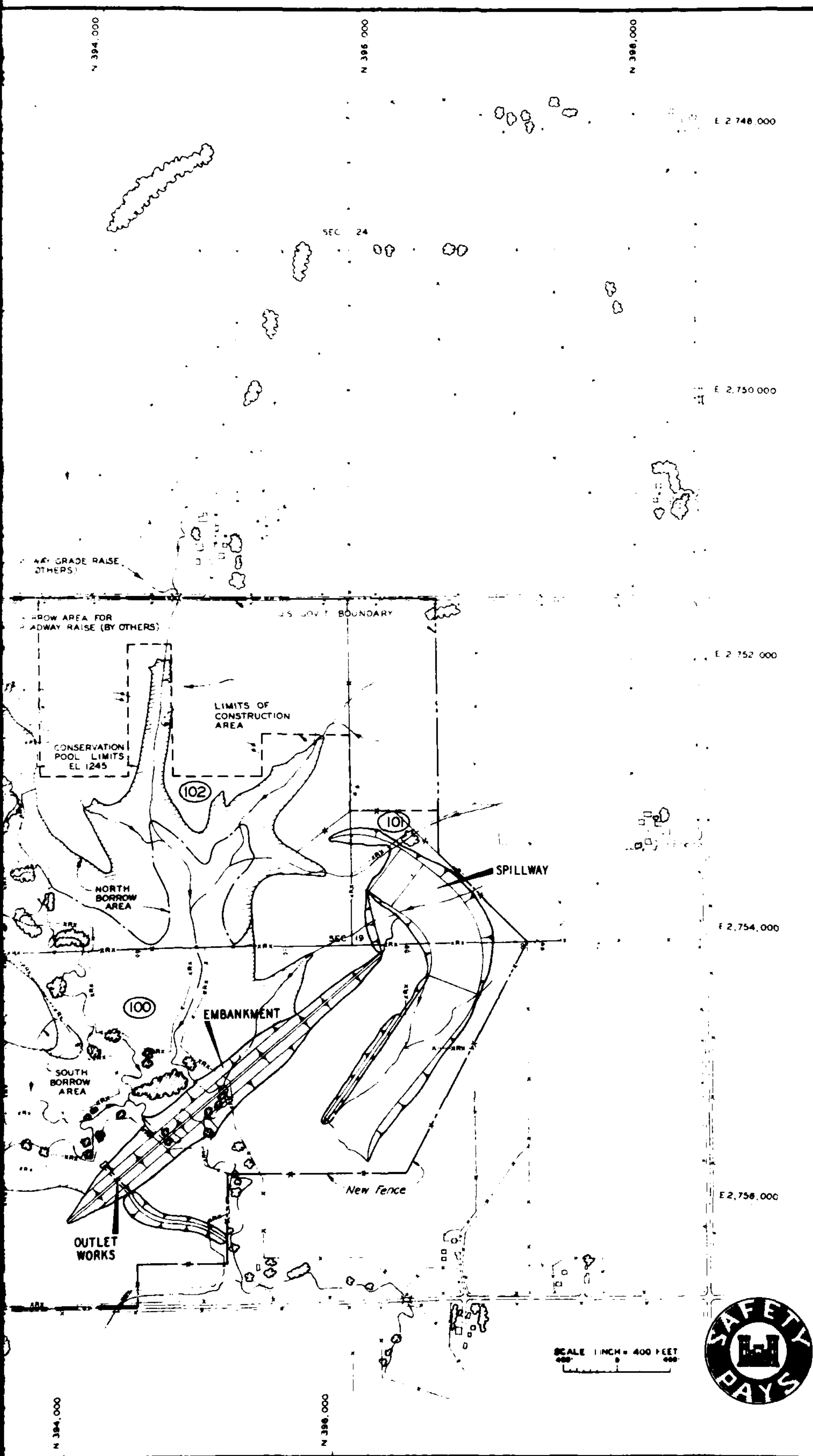
THIS PLAN ACCOMPANIES CONTRACT NO.
DACA45 MODIFICATION NO.

$$ THINK VALUE ENGINEERING $$

CORPS OF ENGINEERS



U. S. ARMY



LEGEND

APPROX AREAS OF TREES AND BRUSH
APPROX AREA TO BE CLEARED
FENCE (APPROX LOCATION)
FENCE TO BE REMOVED
U S GOV'T BOUNDARY
LIMITS OF CONSTRUCTION AREA
BORROW AREA
EXISTING POWERLINE
BUILDING LOCATIONS
TRACT BOUNDARY LINE
POWERLINE RELOCATION (BY OTHERS)
CLEARING LIMITS

GENERAL NOTES:

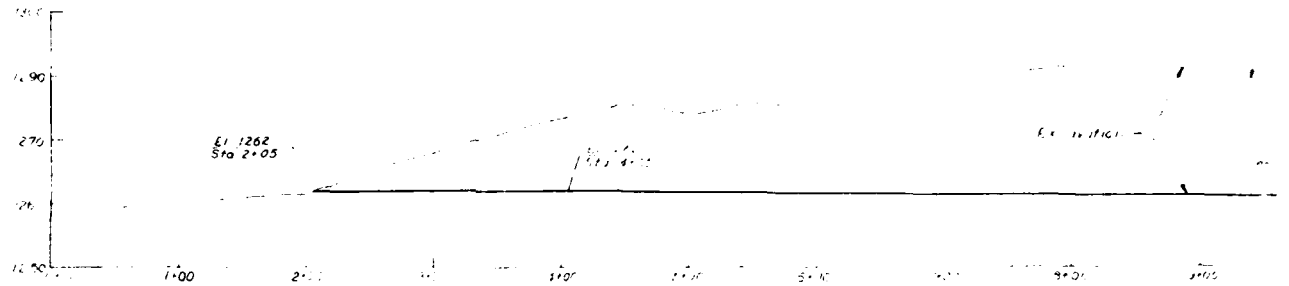
1. All utility lines within the limits of the conservation pool will be removed by others.

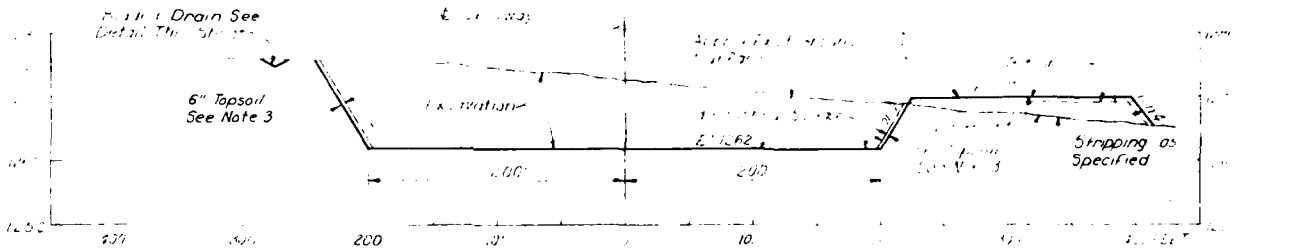
U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

SALT CREEK AND ITS TRIBUTARIES, NEBRASKA
YANKEE HILL DAM AND LAKE
SITE NO. 10
GENERAL PLAN
AND AREA USE

DESIGNED BY: M.J.S. J.W.R.
DRAWN BY: E.H.B.
TRACED BY: E.H.B.
CHECKED BY: R.A.C. L.J.B.
DATE: MARCH
SCALE: AS SHOWN
MSC II - 310E 2

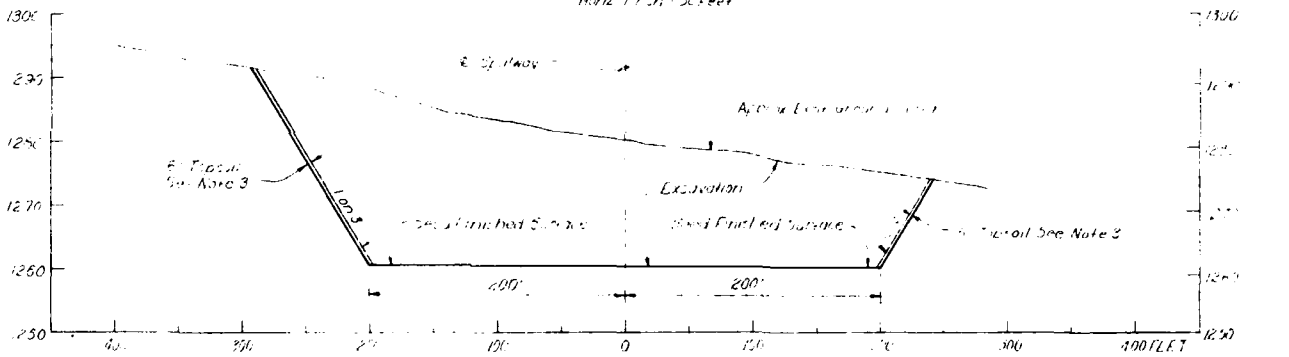
CORPS OF ENGINEERS





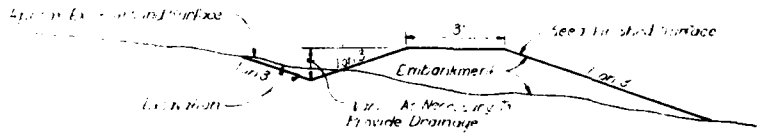
SPILLWAY SECTION E E

SCALE Vert 1 Inch = 10 Feet
Horiz 1 Inch = 50 Feet



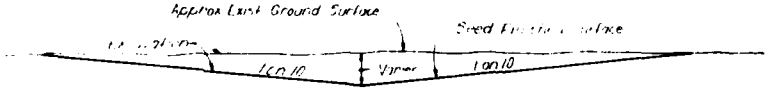
SPILLWAY SECTION F F

SCALE Vert 1 Inch = 10 Feet
Horiz 1 Inch = 50 Feet



TERRACE DETAIL

SCALE: ½ INCH = 1 FOOT



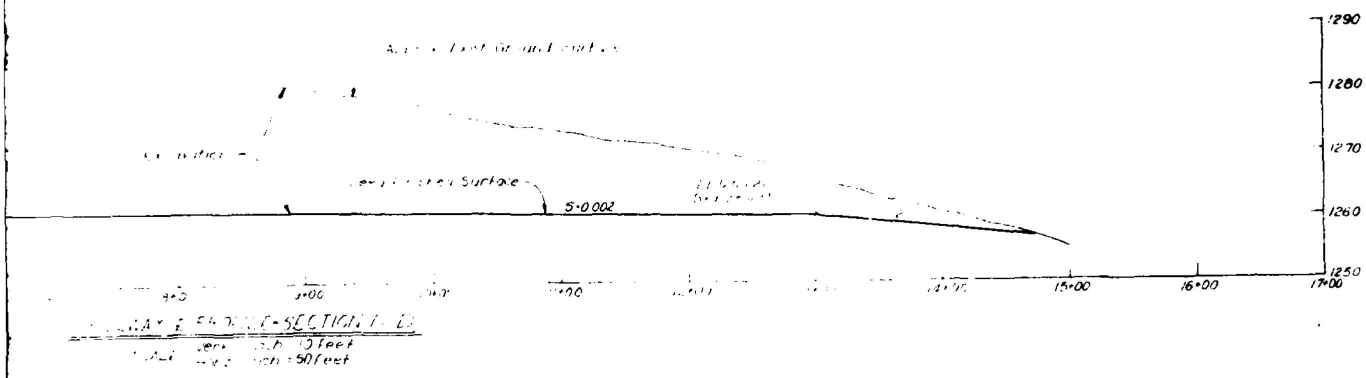
BLADED DRAIN DITCH

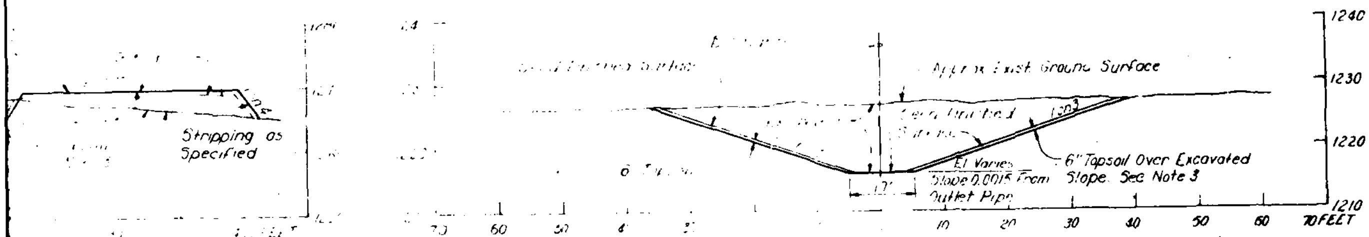
NO SCALE

A 185 Micrometer Film or a Paper Reproducible Record Copy Must Be Made Before Every Amendment and/or Modification

AMENDMENT	
DATE	
MODIFICATION	
DATE	

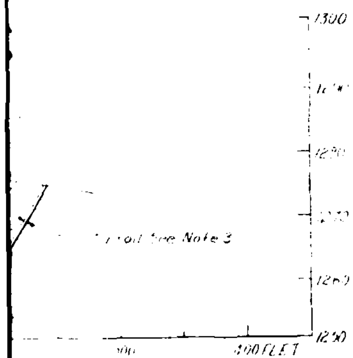
U. S. ARMY





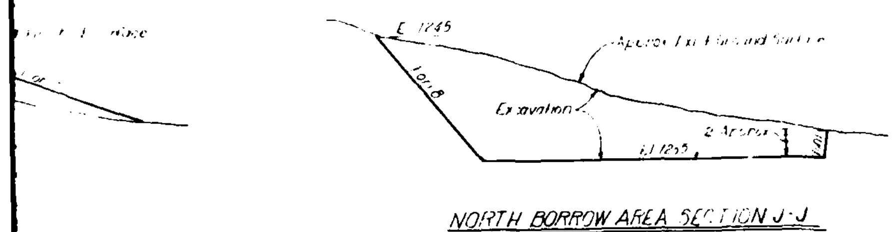
OUTLET WORKS CHANNEL SECTION C-C

SCALE 1 INCH = 10 FEET



GENERAL NOTES:

1. All elevations shown refer to feet above M.S.L., 1954 General Adjustment.
2. For location of profiles and sections see Plate A 4
3. Place 6" layer of topsoil on excavated 1 on 3 slopes of Spillway and Outlet Works Channel from the bottom of the Spillway or Channel to the top of the slope.



NORTH BORROW AREA SECTION J-J

SCALE: Vert 1 Inch = 5 Feet; Horiz 1 Inch = 50 Feet

THIS DRAWING HAS BEEN REDUCED TO THREE-EIGHTHS THE ORIGINAL SCALE.

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

SALT CREEK AND ITS TRIBUTARIES, NEBRASKA
YANKEE HILL DAM AND LAKE
SITE NO.10
SPILLWAY
PROFILE, SECTIONS AND DETAILS

DESIGNED BY: J.W.K.
DRAWN BY: W.L.H.
TRACED BY: W.L.H.
CHECKED BY: L.J.S.

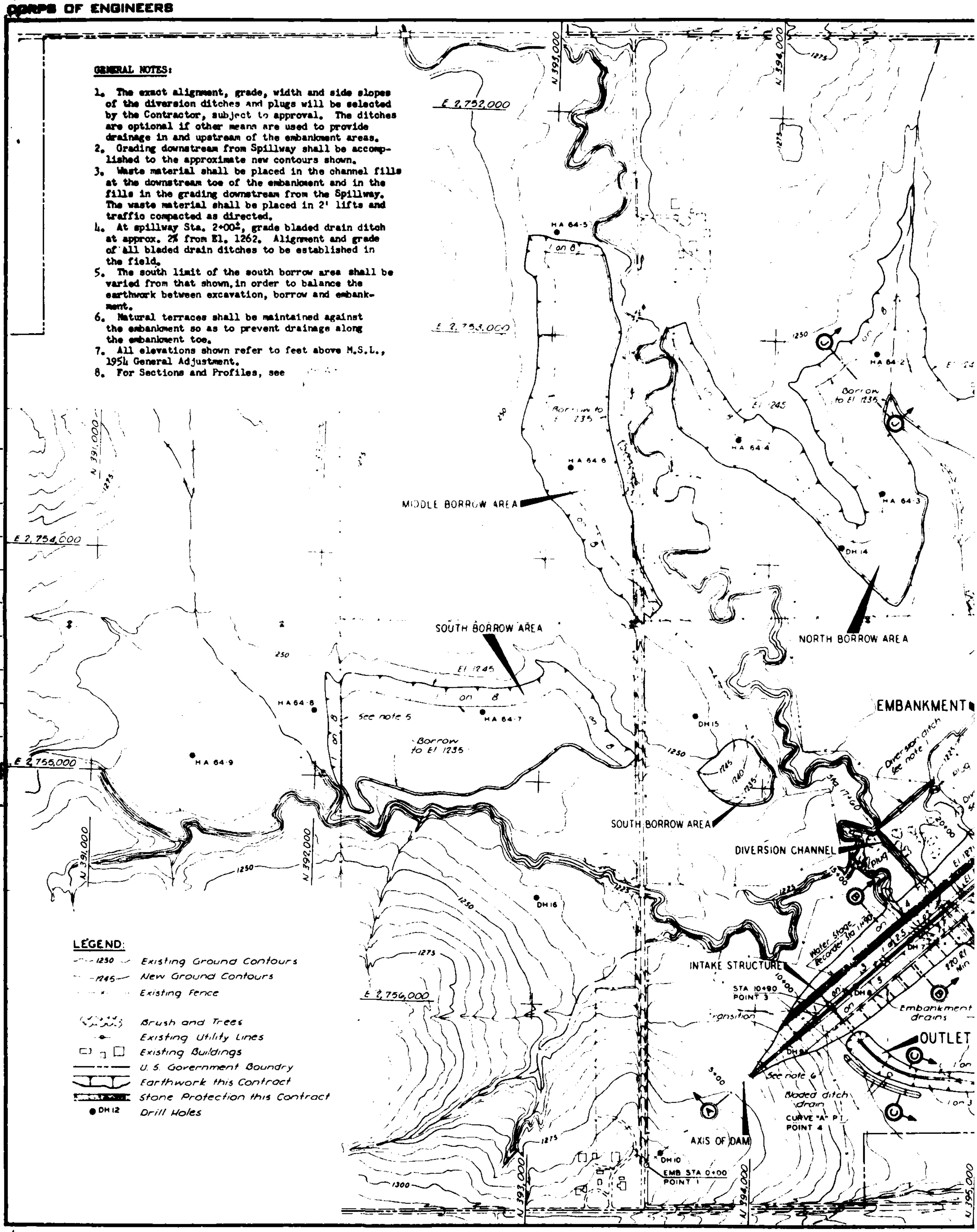
DATE: MARCH 1965
SCALE: AS SHOWN
MSC 11 - 310E6

SAFETY PAYS

CORPS OF ENGINEERS

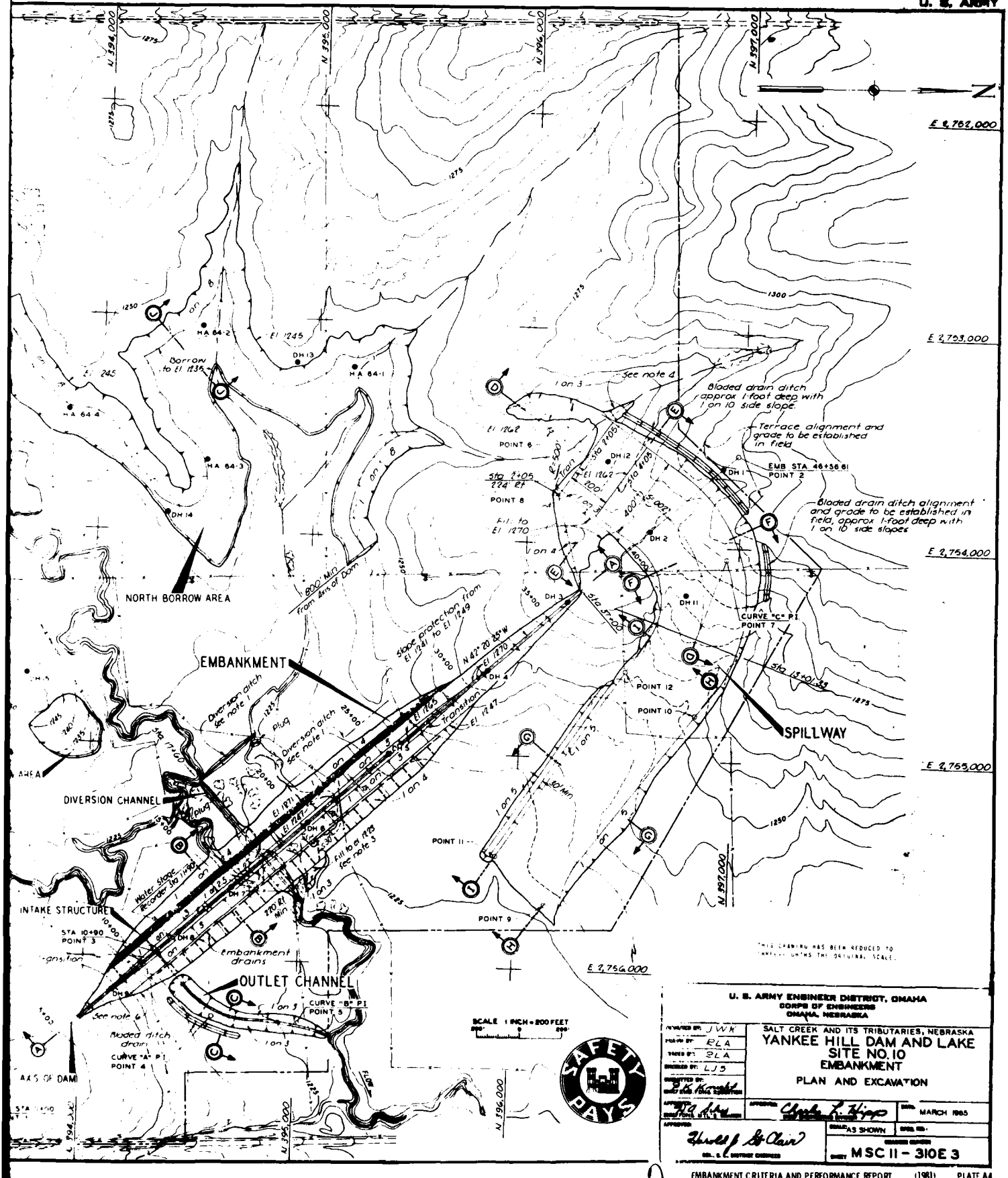
GENERAL NOTES:

1. The exact alignment, grade, width and side slopes of the diversion ditches and plugs will be selected by the Contractor, subject to approval. The ditches are optional if other means are used to provide drainage in and upstream of the embankment areas.
2. Grading downstream from Spillway shall be accomplished to the approximate new contours shown.
3. Waste material shall be placed in the channel fills at the downstream toe of the embankment and in the fills in the grading downstream from the Spillway. The waste material shall be placed in 2' lifts and traffic compacted as directed.
4. At spillway Sta. 2+00±, grade bladed drain ditch at approx. 2% from El. 1262. Alignment and grade of all bladed drain ditches to be established in the field.
5. The south limit of the south borrow area shall be varied from that shown, in order to balance the earthwork between excavation, borrow and embankment.
6. Natural terraces shall be maintained against the embankment so as to prevent drainage along the embankment toe.
7. All elevations shown refer to feet above M.S.L., 1954 General Adjustment.
8. For Sections and Profiles, see



LEGEND:

- 1250 — Existing Ground Contours
- 1245 — New Ground Contours
- Existing Fence
- Brush and Trees
- Existing Utility Lines
- Existing Buildings
- U. S. Government Boundry
- Earthwork this Contract
- Stone Protection this Contract
- ● DH 12 Drill Holes



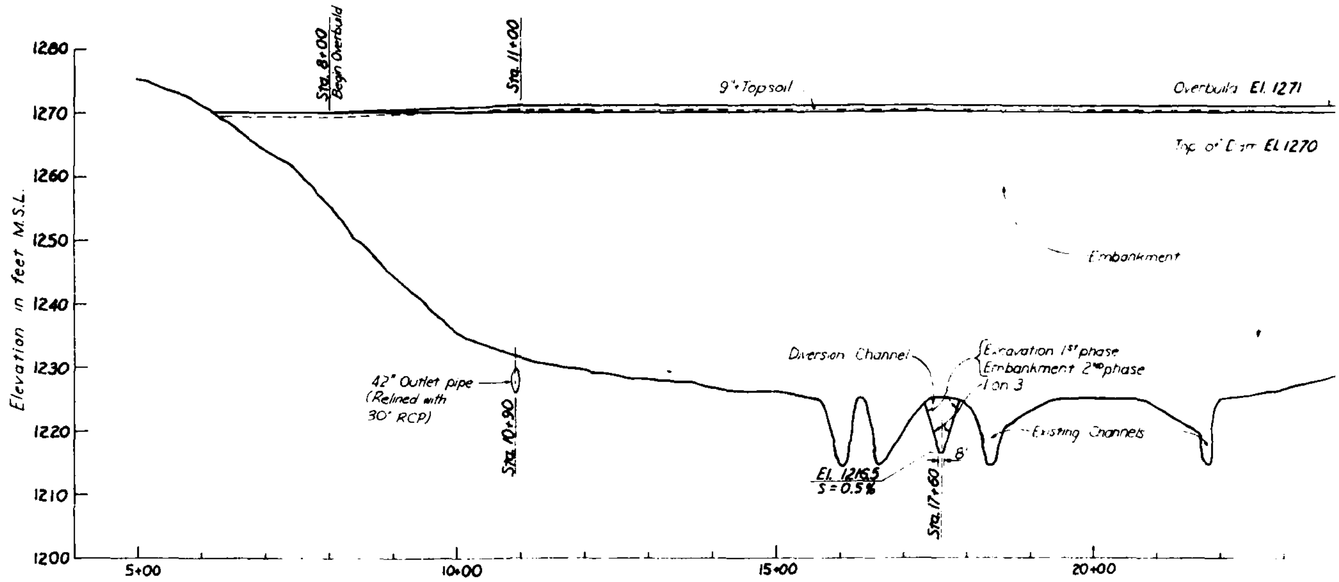
U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

SALT CREEK AND ITS TRIBUTARIES, NEBRASKA
YANKEE HILL DAM AND LAKE
SITE NO. 10
EMBANKMENT
PLAN AND EXCAVATION

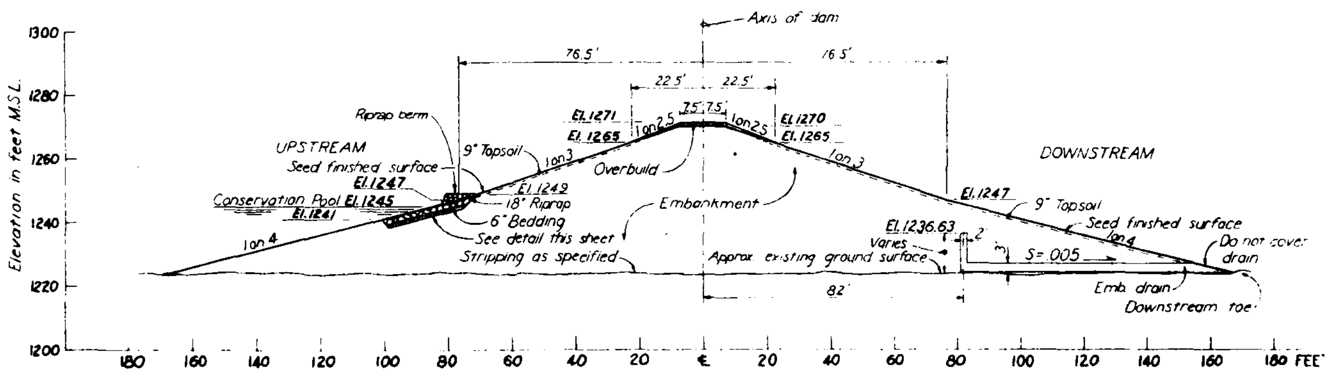
DESIGNED BY: JWK
DRAWN BY: RLA
TRACED BY: RLA
CHECKED BY: LJS
SUBMITTED BY: [signature]
APPROVED: [signature]
APPROVED: [signature]
DATE: MARCH 1985
SCALE: AS SHOWN
DRAWING NO. MSC 11 - 310E 3

EMBANKMENT CRITERIA AND PERFORMANCE REPORT (1981) PLATE A4

CORPS OF ENGINEERS

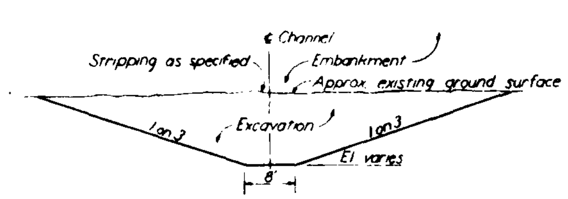


PROFILE ALONG AXIS OF DAM - SECTION



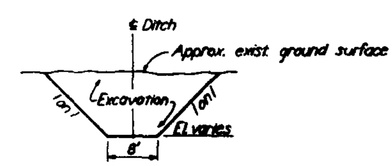
EMBANKMENT SECTION B-B

SCALE: 1 INCH = 20 FEET



TYPICAL DIVERSION CHANNEL SECTION THRU EMBANKMENT

NO SCALE

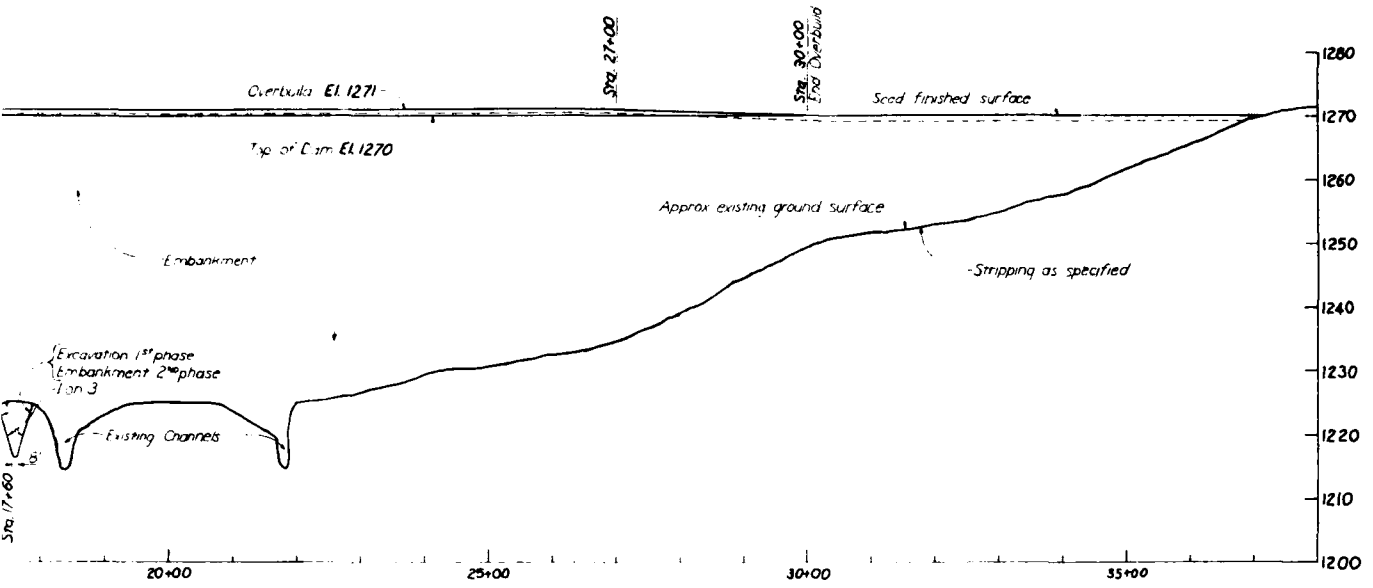


TYPICAL DIVERSION DITCH SECTION

NO SCALE

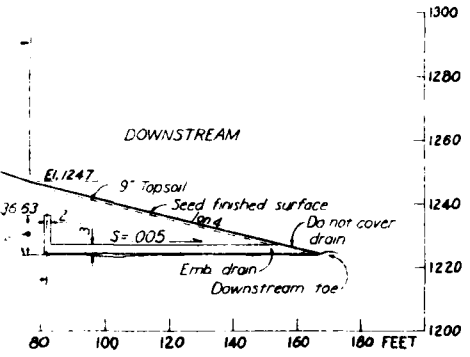
A 105 Microreader Film or a Paper Reproducible Record Copy Must Be Made Before Every Amendment and/or Modification

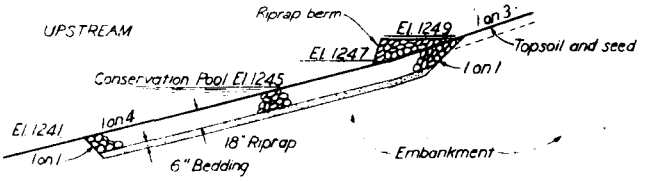
AMENDMENT | DATE | MODIFICATION | DATE



PROFILE ALONG AXIS OF DAM - SECTION A-A

SCALE VERT. 1 INCH = 10 FEET
HORIZ. 1 INCH = 100 FEET

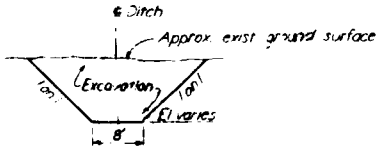




RIPRAP DETAIL
NO SCALE

GENERAL NOTES:

1. All elevations shown refer to feet above M.S.L., 1954 General Adjustment.
2. For location of profile and sections, see Plate A-4 .



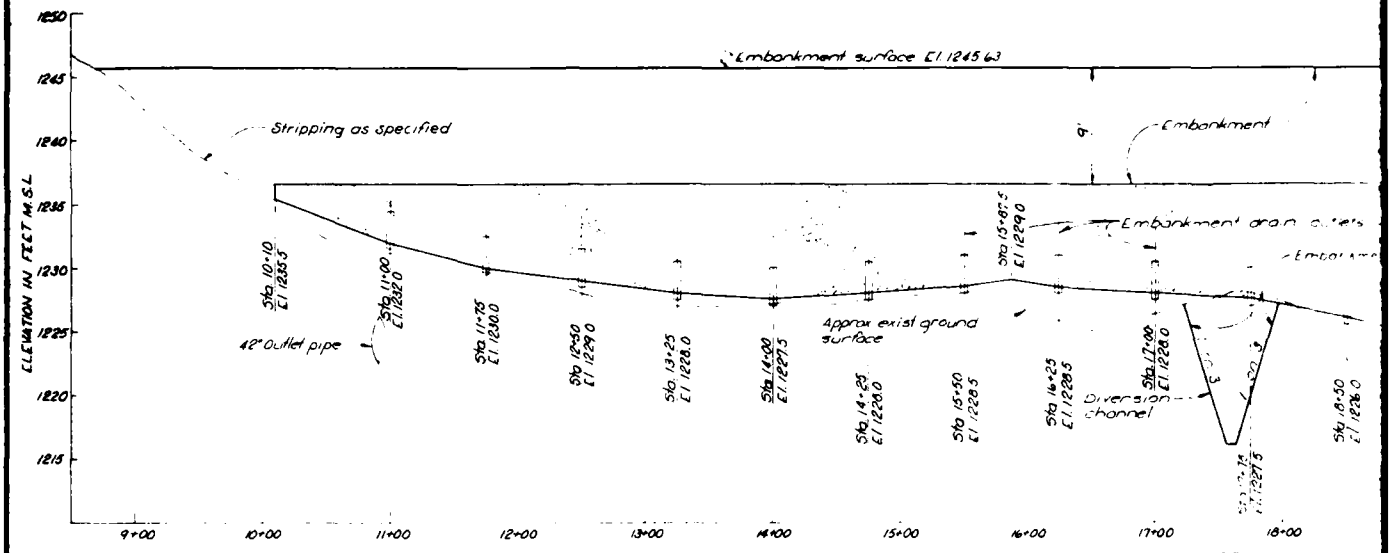
AL DIVERSION DITCH SECTION
NO SCALE

THIS DRAWING HAS BEEN REDUCED TO THREE-FOURTHS THE ORIGINAL SCALE.

U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA	
DESIGNED BY: WK DRAWN BY: TAJ TRACED BY: TAJ CHECKED BY: GJS	SALT CREEK AND ITS TRIBUTARIES, NEBRASKA YANKEE HILL DAM AND LAKE SITE NO. 10 EMBANKMENT PROFILE, SECTIONS AND DETAILS
SUBMITTED: [signature] CHIEF, PDB & E&TS BRANCH	APPROVED: [signature] CHIEF, ENGINEERING DIVISION DATE: MARCH 1965
APPROVED: [signature] COL., U. S. ARMY, DISTRICT ENGINEER	SCALE AS SHOWN CONTRACT NUMBER DACW 56-65-C-0053 DRAWING NUMBER MSC 11-310E4

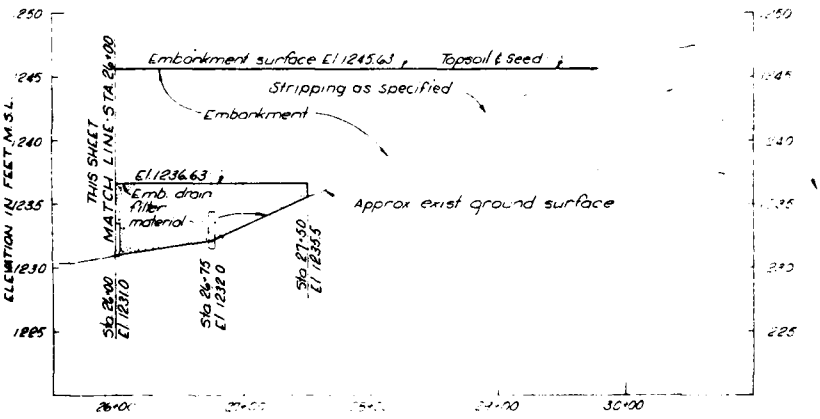
SAFETY DAYS

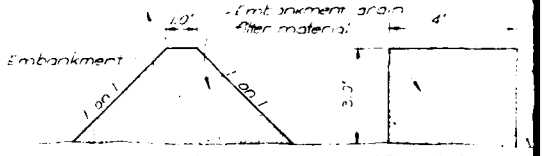
CORPS OF ENGINEERS



EMBANKMENT DRAIN PROFILE

SCALE: HORIZ 1 INCH = 50 FEET
VERT 1 INCH = 5 FEET

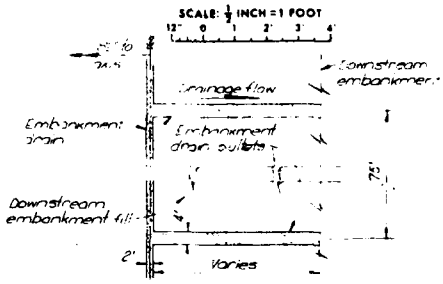




TYPICAL SECTION EMBANKMENT DRAIN OUTLET

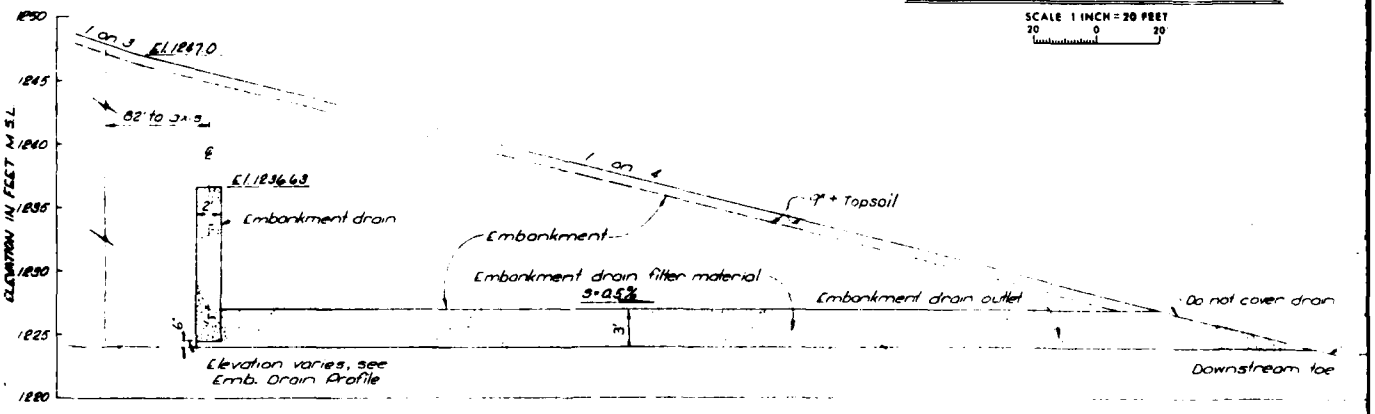
ALTERNATE PLANS OF CONSTRUCTION

SCALE: 1/2 INCH = 1 FOOT



PLAN TYPICAL PERVIOUS DRAIN OUTLET

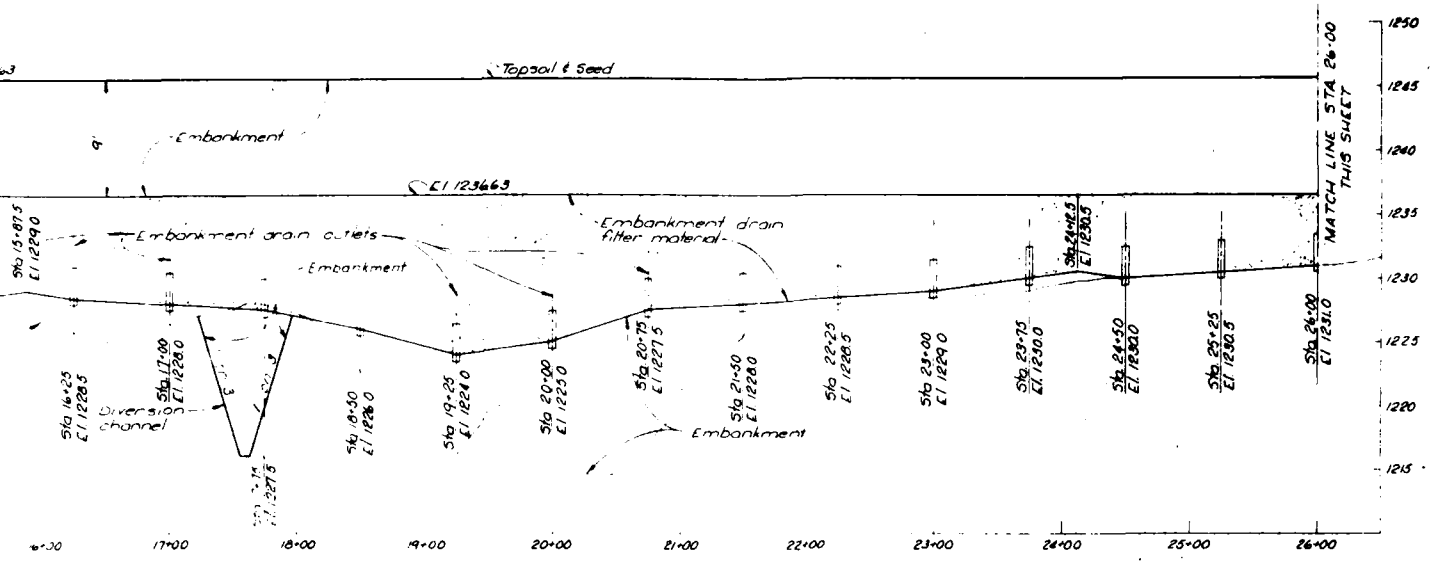
SCALE 1 INCH = 20 FEET



TYPICAL SECTION EMBANKMENT DRAIN OUTLET

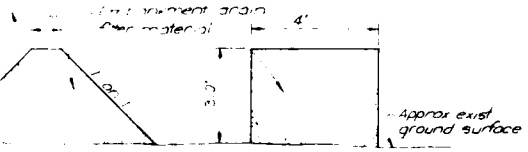
SCALE: 1 INCH = 5 FEET

U. S. ARMY



EMBANKMENT DRAIN PROFILE

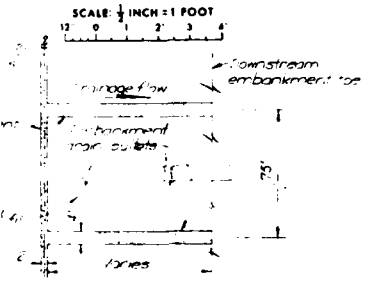
SCALE: HORIZ 1 INCH = 50 FEET
VERT 1 INCH = 5 FEET



SECTION EMBANKMENT DRAIN OUTLET

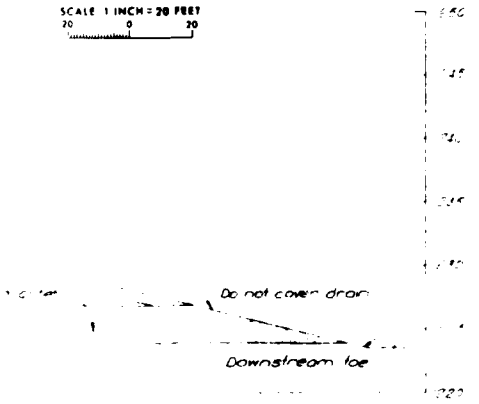
ALTERNATE PLANS OF CONSTRUCTION

SCALE: 1/2 INCH = 1 FOOT



SECTION SERVICE DRAIN OUTLET

SCALE 1 INCH = 20 FEET



GENERAL NOTES:

1. All elevations shown refer to feet above M.S.L., 1954 General Adjustment.
2. For location of Drainage Profiles, see Plate A4

THIS DRAWING HAS BEEN REDUCED TO THREE-EIGHTHS THE ORIGINAL SCALE.

SAFETY PAYS

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

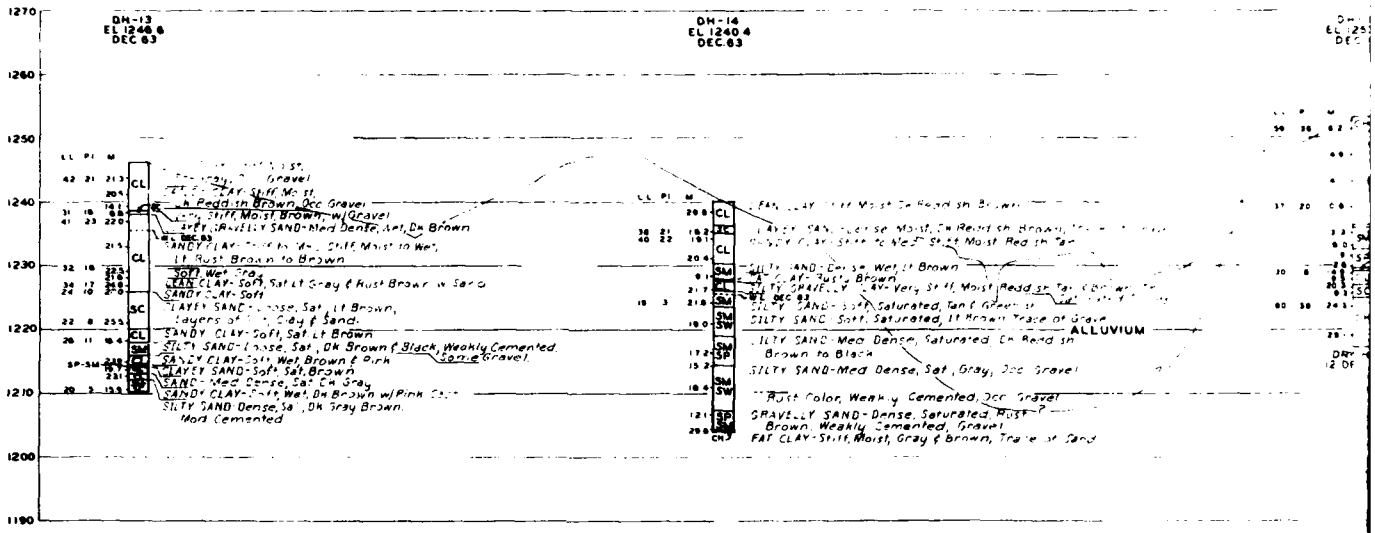
DESIGNED BY: A.W.R.
DRAWN BY: R.A.R.
TRACED BY: R.A.R.
CHECKED BY: L.J.S.
SUBMITTED BY:
CHIEF CONSTRUCTION DIVISION
APPROVED:
CHIEF, ENGINEERING DIVISION

SALT CREEK AND ITS TRIBUTARIES, NEBRASKA
YANKEE HILL DAM AND LAKE
SITE NO. 10
EMBANKMENT
DRAIN PROFILE AND SECTIONS

APPROVED: Charles L. Shaw
CHIEF, ENGINEERING DIVISION
DATE: MARCH 1956
SCALE: AS SHOWN
CONTR. NO.
APPROVED:
Harold J. McClain
COL., C.E., DISTRICT ENGINEER
DRAWING NUMBER: MSC11-310E 5

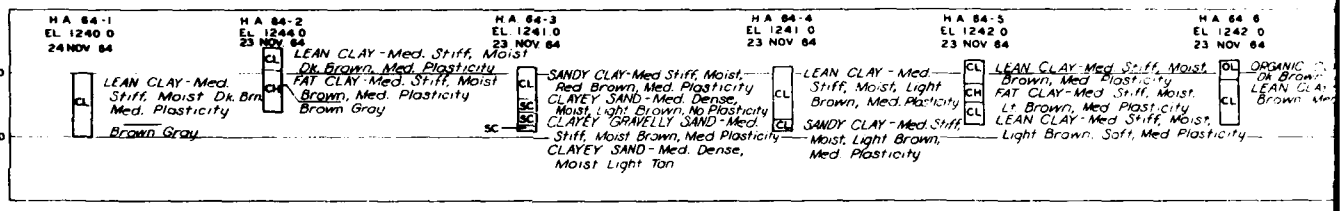
EMBANKMENT CRITERIA AND PERFORMANCE REPORT (1981) PLATE A6

CORPS OF ENGINEERS



BORROW AREA BORINGS

SCALE VERT 1 INCH = 10 FEET
HORIZ 1 INCH = 100 FEET



BORROW AREA BORINGS
(ELEVATIONS ESTIMATED)

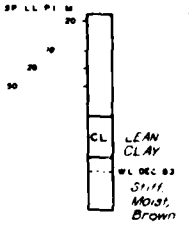
Copy Must Be Made Before Every Addendum and/or Modification

ADDENDA NO.			
DATE			
MODIFICATION			
DATE			

CLASSIFICATION OF SOILS:

CH	FAT CLAY
CL	LEAN CLAY AND SANDY CLAY
ML	SILTS, SANDY SILTS AND CLAYEY SILT
SP	SAND OR GRAVELLY SAND, POORLY GRADED
SW	SAND OR GRAVELLY SAND, WELL GRADED
SM	SILTY SAND OR SILTY GRAVELLY SAND
SC	CLAYEY SAND OR CLAYEY GRAVELLY SAND
OL	ORGANIC CLAY

LEGEND:

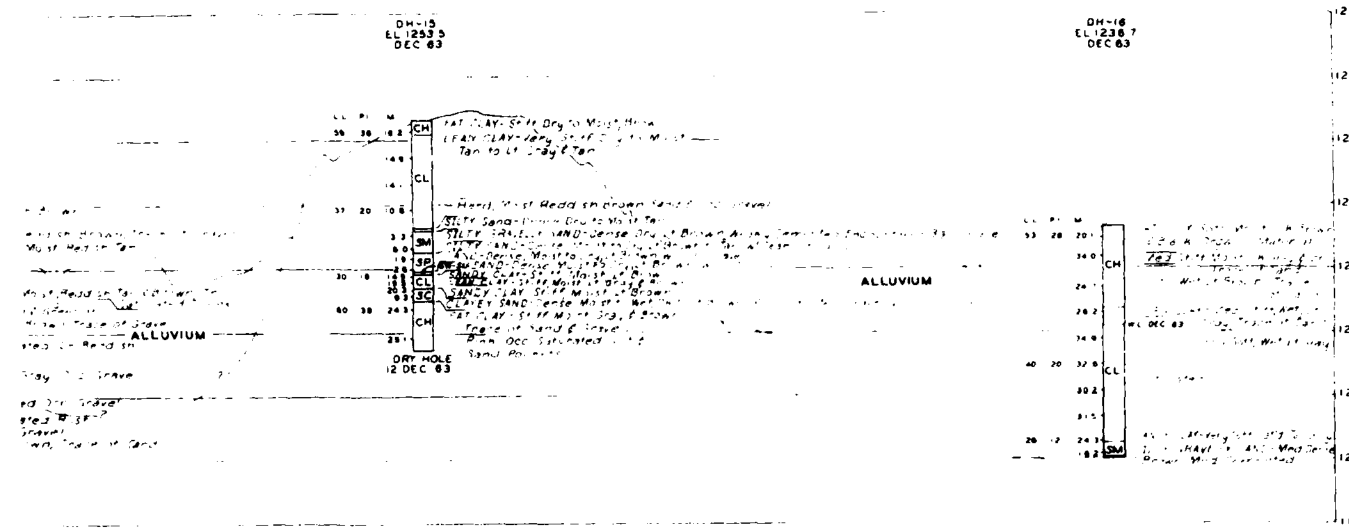


Drill Hole Number
Hand Auger Hole Number
Elevation at top of ground.
Date of boring
(M) Percent of moisture at time of drilling determined by laboratory test.
(P.I.) Plasticity Index
(L.L.) Liquid Limit
(S.P.) Standard Penetration in blows per foot required to drive a 2" O.D. sampler by dropping a 140 lb. hammer 30 inches.
Soil Classification based on Atterberg Limits, Mechanical Analysis and Visual Inspection.
Static Water Level and date recorded.
Inspectors field description of soil encountered

NOTES:

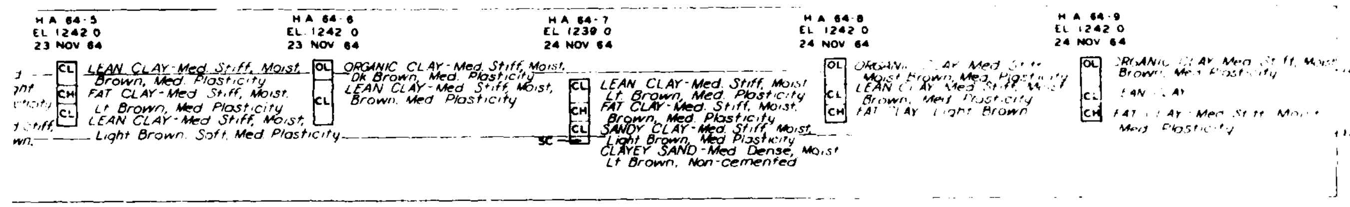
1. Soil de color etc field are log.
2. The dat for each actual ge at the lo the borin condition for their variation materials if encoun considere the purvi
3. Absence of any bo strued th ered in e
4. Informa in the Gr is shown at the Or
5. Undistu a rotary tube samp with a pe diameter

U. S. ARMY



BORROW AREA BORINGS

SCALE VERT 1 INCH = 10 FEET
HORIZ 1 INCH = 100 FEET



H A 64-5
EL 1242.0
23 NOV 64
LEAN CLAY-Med. Stiff, Moist, Brown, Med. Plasticity
FAT CLAY-Med. Stiff, Moist, Lt. Brown, Med. Plasticity
LEAN CLAY-Med. Stiff, Moist, Light Brown. Soft, Med. Plasticity
H A 64-6
EL 1242.0
23 NOV 64
ORGANIC CLAY-Med. Stiff, Moist, Dk. Brown, Med. Plasticity
LEAN CLAY-Med. Stiff, Moist, Brown, Med. Plasticity
H A 64-7
EL 1239.0
24 NOV 64
LEAN CLAY-Med. Stiff, Moist, Lt. Brown, Med. Plasticity
FAT CLAY-Med. Stiff, Moist, Brown, Med. Plasticity
SANDY CLAY-Med. Stiff, Moist, Light Brown, Med. Plasticity
CLAYEY SAND-Med. Dense, Moist, Lt. Brown, Non-cemented
H A 64-8
EL 1242.0
24 NOV 64
H A 64-9
EL 1242.0
24 NOV 64
1240
1230

BORROW AREA BORINGS

(ELEVATIONS ESTIMATED)

NOTES:

1. Soil descriptions (consistency, moisture, color etc.) based on visual inspection in the field are shown to the right of the graphic log.
2. The data shown graphically and by symbol for each respective boring represents the actual geologic features observed and logged at the location given on the drawing. While the borings are representative of subsurface conditions at their respective locations and for their respective vertical reaches, local variations characteristic of the subsurface materials of this region are anticipated and if encountered, such variations will not be considered as differing "materially" within the purview of Article IV of the contract.
3. Absence of water readings in the Graphic Log of any boring is not necessarily to be construed that ground water will not be encountered in excavation at this location.
4. Information on material has been condensed in the Graphic Logs. Additional information is shown on field logs, which may be inspected at the Omaha District Office.
5. Undisturbed sampling was accomplished with a rotary drill using a 5 inch diameter Shelby tube sampler. Disturbed samples were obtained with a percussion type drill using a 6 inch diameter open end drive barrel.

GENERAL NOTES:

1. All elevations shown refer to feet above M.S.L., 1954 General Adjustment.
2. For location of borings, see Plate A-4

THIS DRAWING HAS BEEN REDUCED TO THREE-EIGHTHS THE ORIGINAL SCALE.

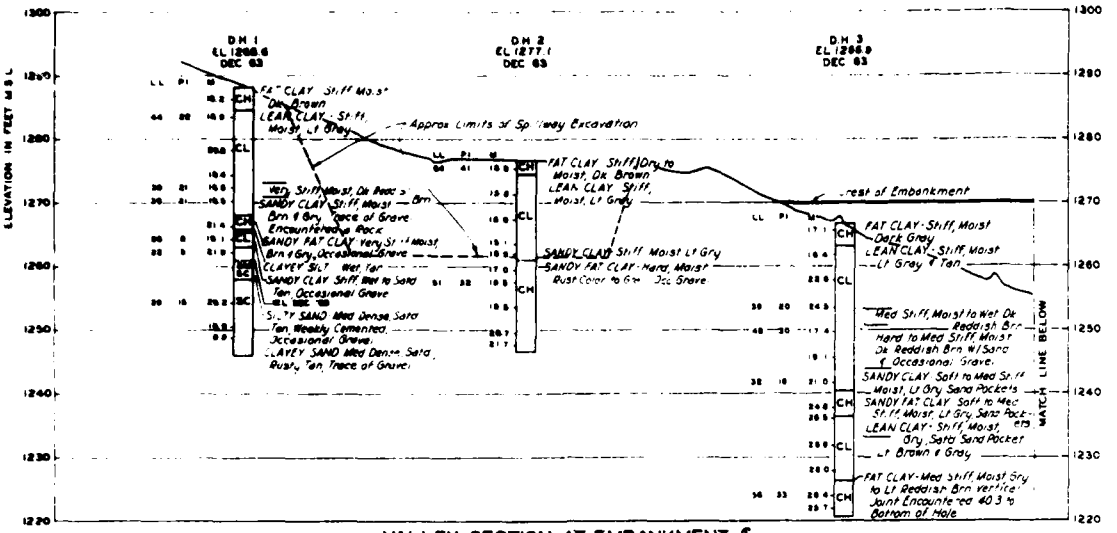
U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

SALT CREEK AND ITS TRIBUTARIES, NEBRASKA
YANKEE HILL DAM AND LAKE
SITE NO. 10
BORING LEGEND AND
RECORD OF BORINGS-BORROW AREA

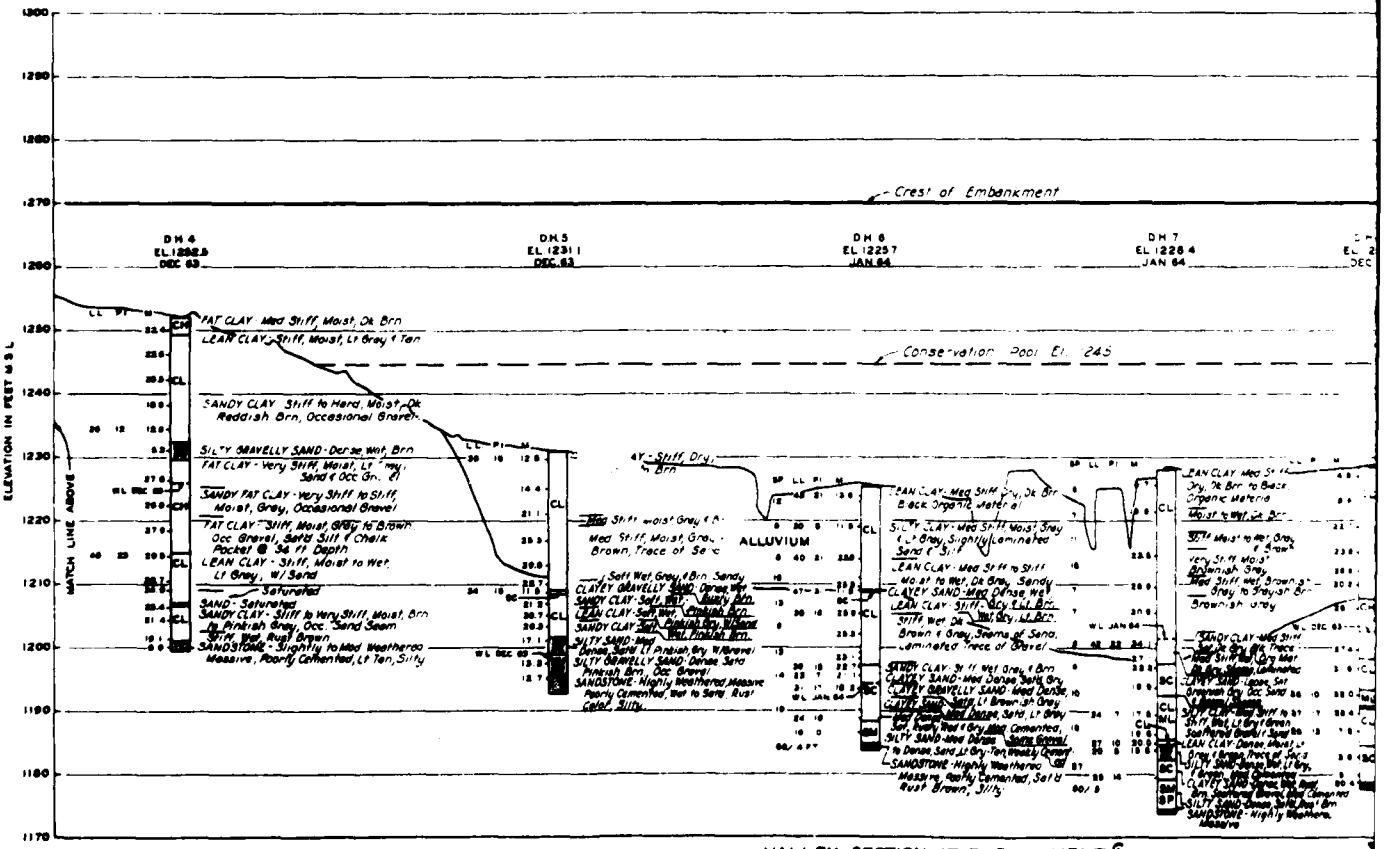
DATE: MAR 1965

MSC11-310E10

CORPS OF ENGINEERS

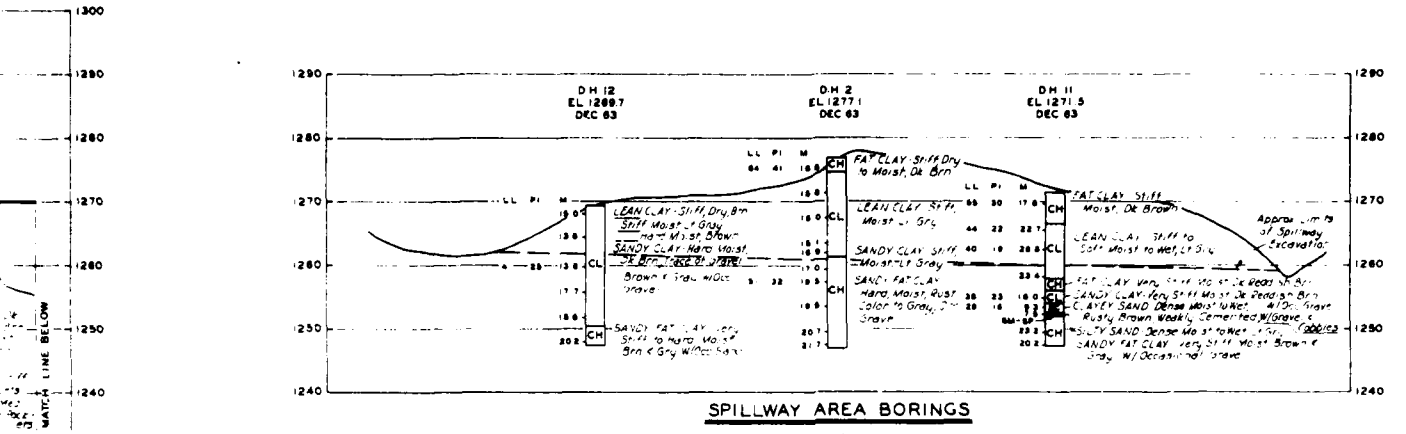


VALLEY SECTION AT EMBANKMENT ℄



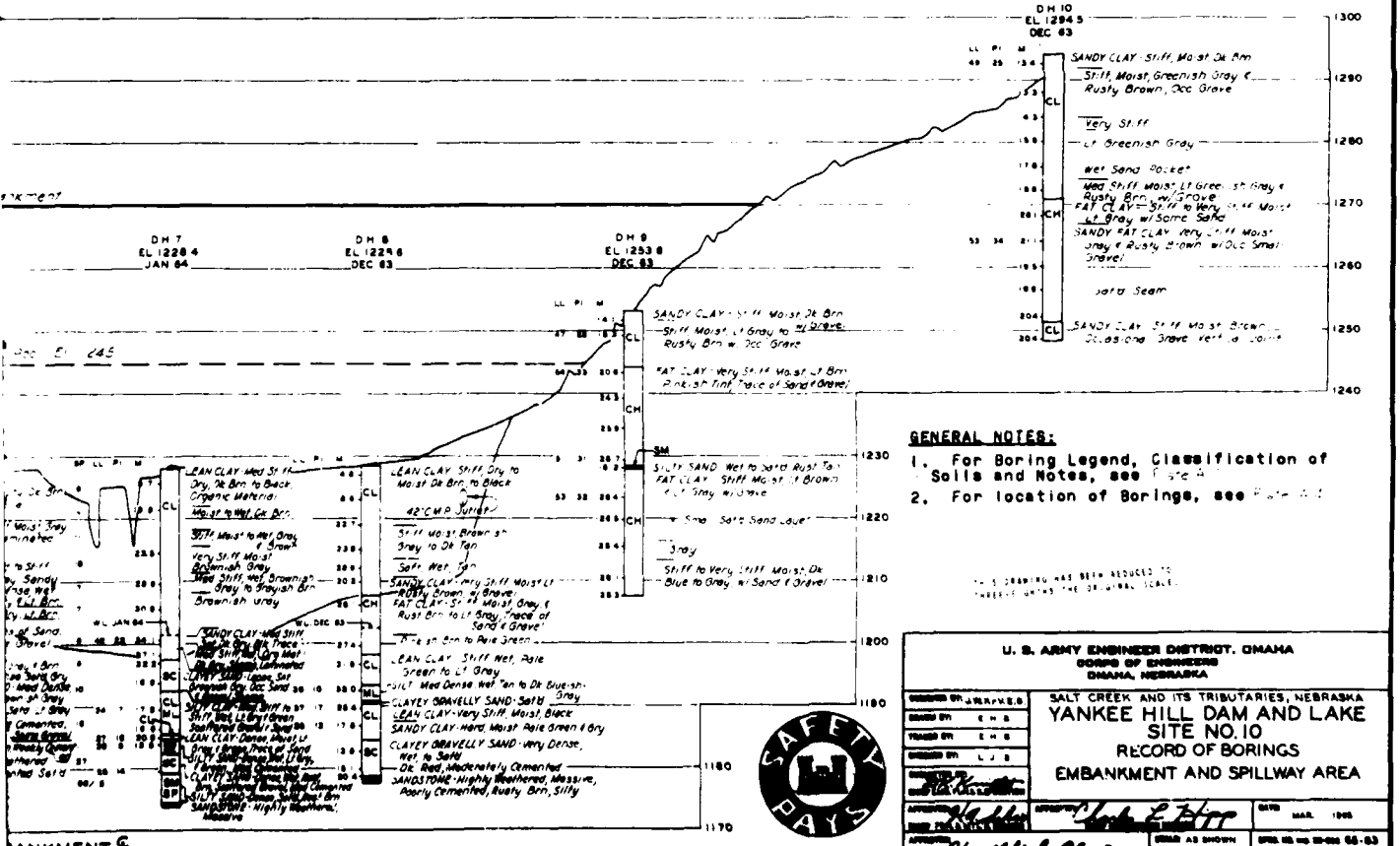
VALLEY SECTION AT EMBANKMENT ℄

SCALE: VERT 1 INCH = 10 FT
HORIZ 1 INCH = 100 FT



SPILLWAY AREA BORINGS

SCALE: VERT 1 INCH = 10 FEET
HORIZ 1 INCH = 100 FEET



GENERAL NOTES:

1. For Boring Legend, Classification of Soils and Notes, see Plate A1
2. For location of Borings, see Plate A2

THIS DRAWING HAS BEEN REDUCED TO THREE-FIFTHS OF THE ORIGINAL SCALE.

SAFETY PAYS

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

SALT CREEK AND ITS TRIBUTARIES, NEBRASKA

YANKEE HILL DAM AND LAKE SITE NO. 10

RECORD OF BORINGS

EMBANKMENT AND SPILLWAY AREA

DESIGNED BY: J.W.R.P.M.E.D.
DRAWN BY: E.M.S.
TRACED BY: E.M.S.
CHECKED BY: L.J.S.

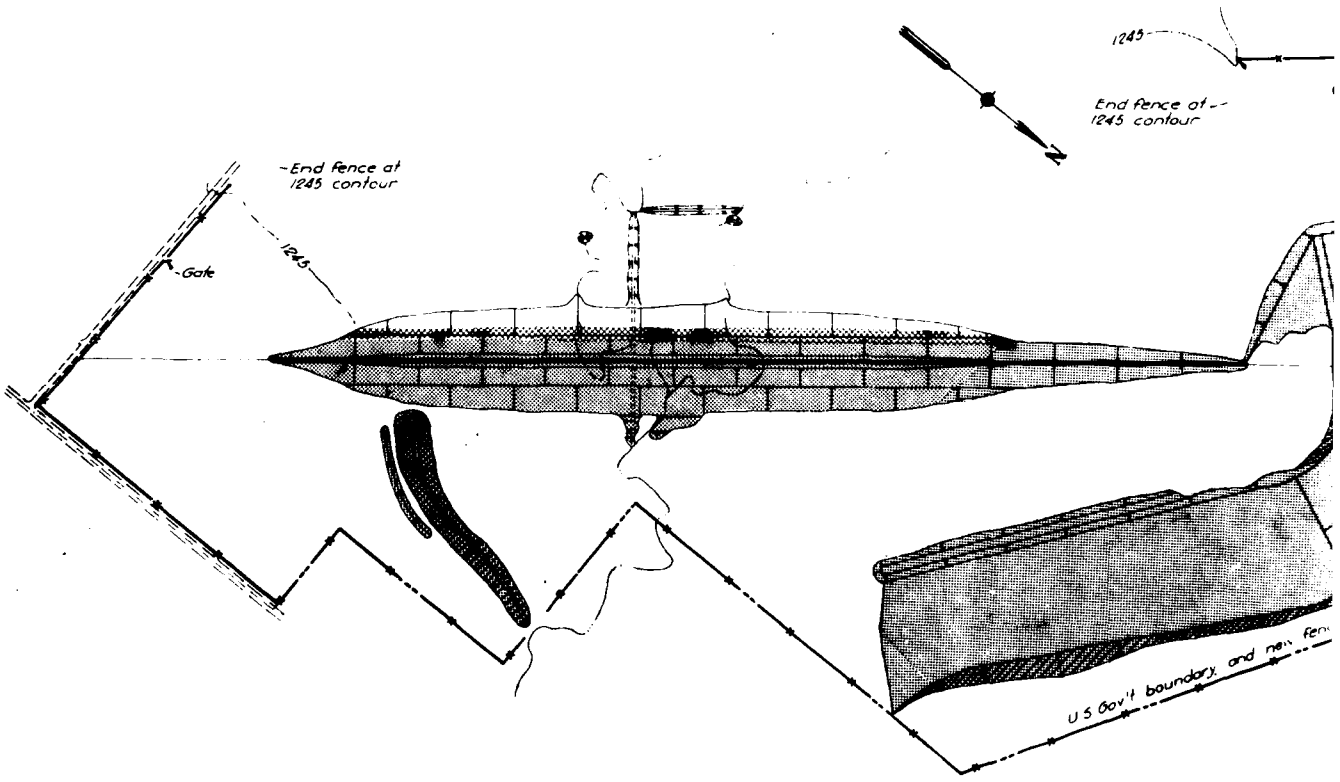
APPROVED: Charles E. Hoff
DATE: MAR. 1965

APPROVED: Harold J. McClure
COL., C.E., DISTRICT ENGINEER

SCALE: AS SHOWN

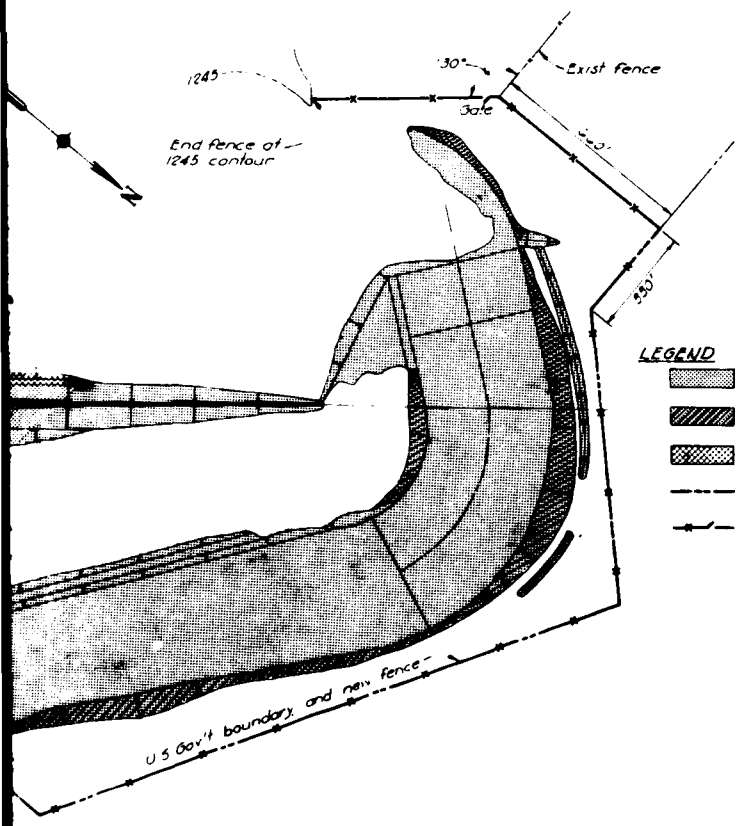
MSC11-310E11

CORPS OF ENGINEERS



SLOPE PROTECTION AND FENCING PLAN

SCALE 1 INCH = 200 FEET



AND FENCING PLAN

H = 200 FEET

GENERAL NOTE:

All areas disturbed by grading under this contract shall be seeded. Disturbed areas upstream and below elevation 1245 and riprap areas shall not be seeded. Areas disturbed by the contractor outside the above indicated areas for which approval has not been secured, shall be seeded by and at the expense of the contractor.

LEGEND

- Seeding, see note
- Topsoil of excavated slopes and seeding
- Embankment stone protection
- U.S. Gov't boundary
- Fence and gate this contract

THIS DRAWING HAS BEEN REDUCED TO THREE-EIGHTHS THE ORIGINAL SCALE.

SAFETY PAYS

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

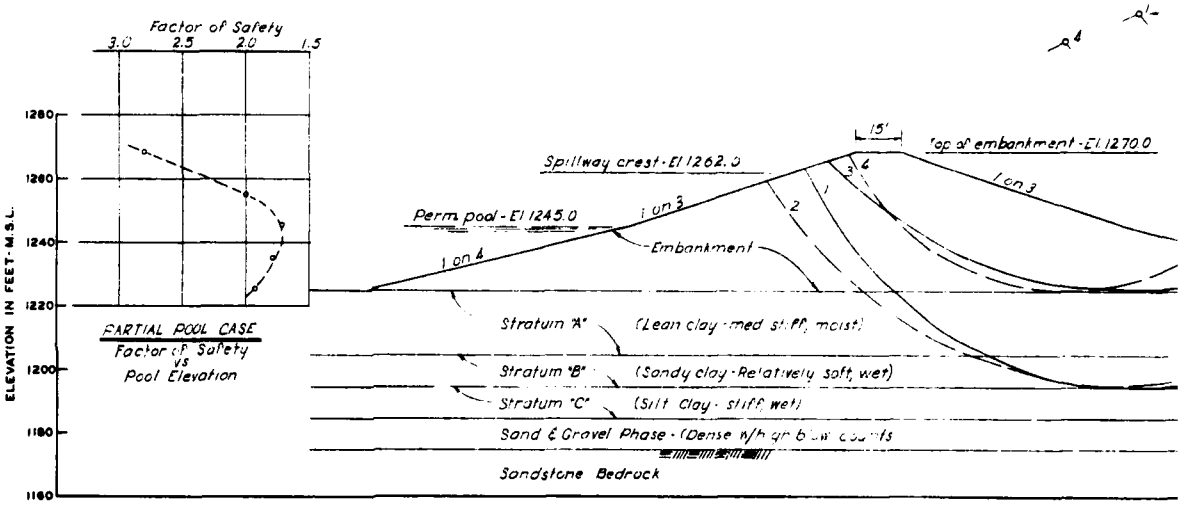
DESIGNED BY J.W.K.	SALT CREEK AND ITS TRIBUTARIES, NEBRASKA
DRAWN BY D.E.H.	YANKEE HILL DAM AND LAKE
TRACED BY D.E.H.	SITE NO. 10
CHECKED BY L.J.S.	SLOPE PROTECTION AND FENCING DETAILS
SUBMITTED	APPROVED: Charles L. Hipp — DATE: MARCH 1965
APPROVED: Harold E. St. Clair	DRAWING NUMBER: MSC II-310E-9

2

CORPS OF ENGINEERS

SUMMARY OF STABILITY STUDIES

CASE	SHEAR STRENGTH	CRITICAL ARC	ELEVATION OF WATER	SAFETY FACTORS COMPUTED	SAFETY FACTORS REQUIRED	SAFETY FACTORS WITH EARTHQUAKE COMPUTED	SAFETY FACTORS WITH EARTHQUAKE REQUIRED
END OF CONSTRUCTION	Q	1	1225	3.57	1.3	2.88	1.0
STEADY SEEPAGE	R	3 & 4	1245 TO 1225	1.82	1.5	1.50	1.0
STEADY SEEPAGE	S	1	1245 TO 1225	1.81	1.5	1.44	1.0
SUDDEN DRAWDOWN	R	4	1268 TO 1245	1.45	1.0	NOT APPLICABLE	
PARTIAL POOL	R	4	VARIES SEE GRAPH	1.70 (min.)	1.5	1.38	1.0



STABILITY ANALYSIS - CIRCULAR ARC METHOD

FINITE SLICES - ELECTRONIC COMPUTER PROGRAM

SCALE: 1 INCH = 20 FEET

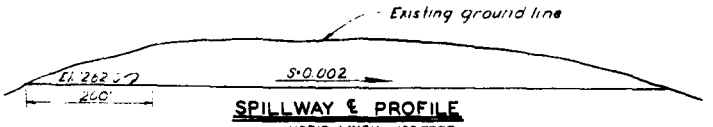
ADOPTED SHEAR STRENGTH VALUES

MATERIAL	UNCONSOLIDATED UNDRAINED (Q) STRENGTH		CONSOLIDATED UNDRAINED (R) STRENGTH		CONSOLIDATED DRAINED (S) STRENGTH	
	TAN Ø	COH T/SF	TAN Ø	COH T/SF	TAN Ø	COH T/SF
EMBANKMENT	0.07	0.90	0.23	0.23	0.50	0
FDN. STRATUM "A"	0	1.68	0.26	0.80	0.58	0
FDN. STRATUM "B"	0	0.65	0.21	0.25	0.76	0
FDN. STRATUM "C"	0	2.00	0.15	1.34	0.60	0

A 105 Micro-master Film or A Paper Reproducible Record Copy Must Be Made Before Every Addendum and/or Modification

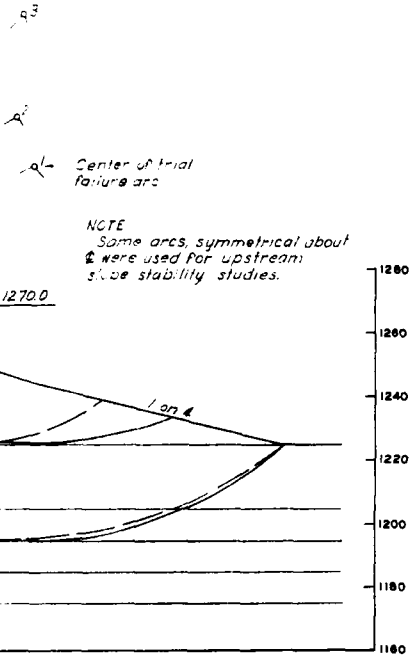
ADDENDA NO.	DATE	MODIFICATION	DATE

ACTORS WITH EARTHQUAKE TED	REQUIRED
S	1.0
D	1.0
A	1.0
CABLE	
S	1.0



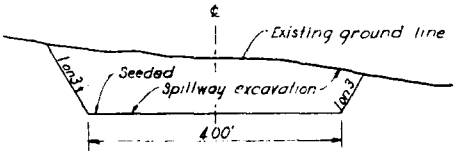
SPILLWAY ℄ PROFILE

SCALE: HORIZ: 1 INCH = 100 FEET
VERT: 1 INCH = 20 FEET



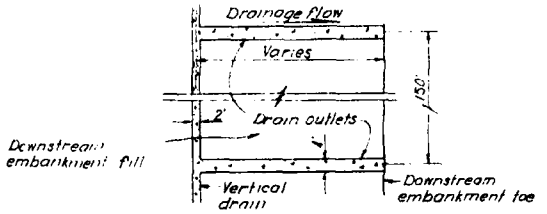
C METHOD

ROGRAM



TYPICAL SPILLWAY SECTION

SCALE: HORIZ: 1 INCH = 100 FEET
VERT: 1 INCH = 20 FEET



PLAN - TYPICAL PERVIOUS DRAIN

SCALE: 1 INCH = 20 FEET

UES

ED TH	CONSOLIDATED DRAINED (S) STRENGTH	
/SF	TAN ϕ	COH T/SF
3	0.50	0
0	0.58	0
5	0.76	0
4	0.60	0

THIS DRAWING HAS BEEN REDUCED TO THREE-EIGHTHS THE ORIGINAL SCALE.

DATE	DESCRIPTION	MADE	APPD
	REVISIONS		

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

SALT CREEK AND ITS TRIBUTARIES, NEBRASKA

DAM AND RESERVOIR, SITE 10

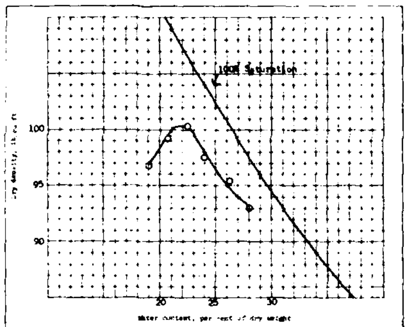
TYPICAL SECTIONS AND STABILITY ANALYSIS

APRIL 1964

SAFETY PAYS

THIS PLAN ACCOMPANIES CONTRACT NO. DA-25-066-
MODIFICATION NO.

CORPS OF ENGINEERS



AASHO T 99-57 A compaction test

25 blows per each of 3 layers, with 5.5 lb rammer and 12 inch drop. 4.0 inch diameter mold

Sample No.	Elev or Depth	Classification	G	LL	PL	% + No. 4	% + 3/4 in.
1		Lean Clay, CL	2.76	47	21	0	0

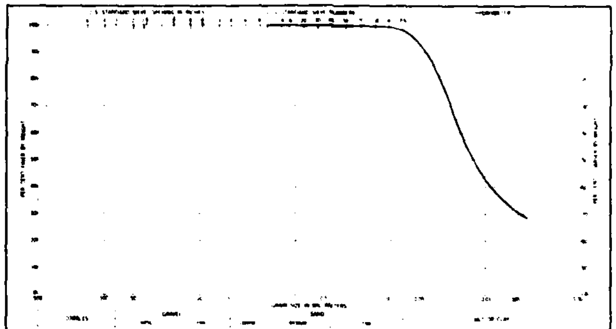
Sample No.				
Natural water content in per cent				
Optimum water content in per cent	21.9			
Max dry density in lb/cu ft	100			

Remarks

Project Salt-Wahoo Site 10 S-875 (Civil)
MISSOURI RIVER DIVISION LABORATORY NO. 63/1274
Composite of DH 1, 2, and 12
Boring No. Date 22 January 1964

COMPACTION TEST REPORT

FIGURE 1

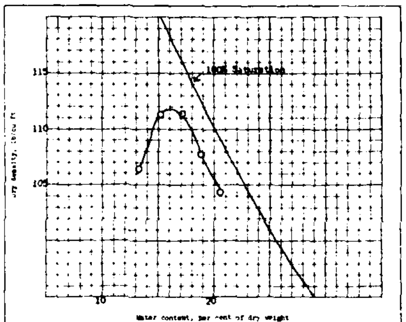


Sample No.	Elev or Depth	Classification		LL	PL	PI
1		Lean Clay, CL		47	21	26

Project Salt-Wahoo Site 10 S-875 (Civil)
MISSOURI RIVER DIV. LAB. NO. 63/1274
Composite of DH 1, 2, and 12
Date 22 January 1964

GRADATION CURVES

FIGURE 2



AASHO T 99-57A compaction test

25 blows per each of 3 layers, with 5.5 lb rammer and 12 inch drop. 4.0 inch diameter mold

Sample No.	Elev or Depth	Classification	G	LL	PL	% + No. 4	% + 3/4 in.
1		Sandy Clay, CL	2.72	34	16	0.5	0.1

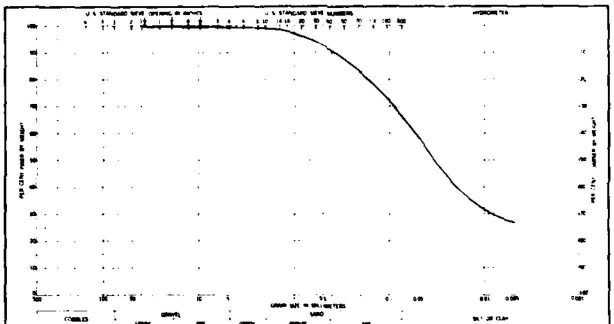
Sample No.				
Natural water content in per cent				
Optimum water content in per cent	16.0			
Max dry density in lb/cu ft	112			

Remarks

Project Salt-Wahoo Site 10 S-875 (Civil)
MISSOURI RIVER DIVISION LAB. NO. 63/1274
Area
Boring No. DH-13 Date 22 January 1964

COMPACTION TEST REPORT

FIGURE 5



Sample No.	Elev or Depth	Classification		LL	PL	PI
1		Sandy Clay, CL		34	16	18

Project Salt-Wahoo Site 10 S-875 (Civil)
MISSOURI RIVER DIV. LAB. NO. 63/1274
Boring No. DH-13
Date 22 January 1964

GRADATION CURVES

FIGURE 6

TABLE 1. - UNCONFINED COMPRESSION AND CLASSIFICATION TEST DATA

TEST REQUEST NO. S-875 (CIVIL)

Salt-Wahoo Site No. 10 — MISSOURI RIVER DIVISION LABORATORY NO. 63/1274

Hole No.	Sample No.	Dry Density (lbs/cu.ft.)	Moisture (percent)	L/D [a]	Breaking Strength (lbs/sq.ft.)	Breaking Strength (ton/sq.ft.)	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Failure Diagram	Classification [b]	Remarks
13	1	106.2	17.2	2.15	19.62	1.41	34	16		Sandy CLAY, CL	Shear failure. Brown sandy clay. This specimen tested in triaxial apparatus. Specimen size: Dia.-1.4", Ht.-3.0"
DH-1, 2, & 12	(Composite) 1	94.3	23.8	2.15	21.97	1.58	47	21		Lean CLAY, CL	Shear failure. Brown lean clay. This specimen tested in a triaxial apparatus. Specimen size: Dia.-1.4", Ht.-3.0"

Notes: (a) L/D denotes ratio of length to diameter of the specimen.
(b) Classification in accordance with Military Standard-619(CE); Unified Soil Classification System for Roads, Airfields, Embankments and Foundations, dated 30 June 1960.

SOIL CLASSIFICATION

PROJECT: Salt-Wahoo Site 10

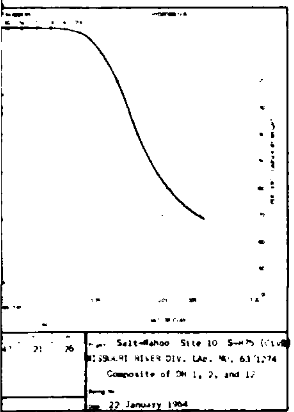
STATION: - RANGE: - SURF. ELEV:

Sample No.	Depth to Bottom of Sample	Moisture (%)	L.L.	P.L.	.005 mm	.02 mm	200	40	10	4	3/8 in.	3/4 in.	D
2	Composite Holes 1, 2, and 12												
			45	26			89	97	100				
3	Composite Holes 1, 2, and 12												
			46	29			84	98	100				
1	Hole 14												
			28	14			11	42	[illegible]	[illegible]	100		.40
1	Hole 16												
			45	21			97	99	100				

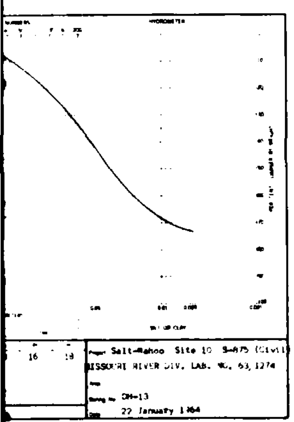
TABLE 2

ADDENDA NO.	DATE	MODIFICATION	DATE

U. S. ARMY



2



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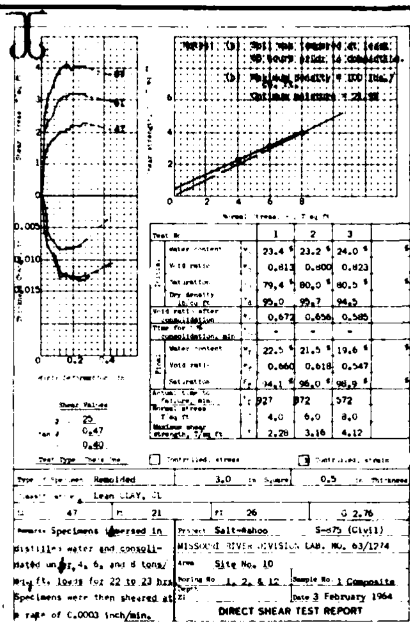


FIGURE 3

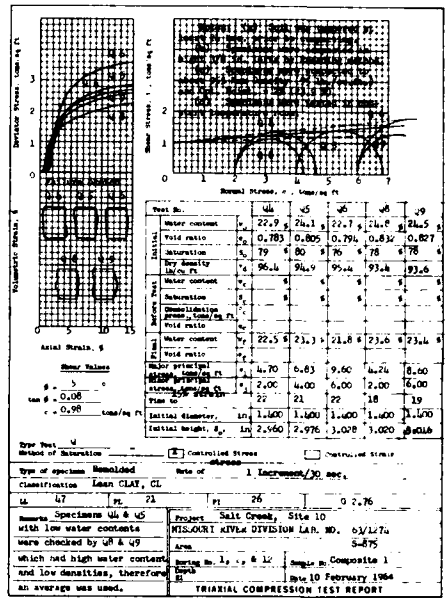


FIGURE 4

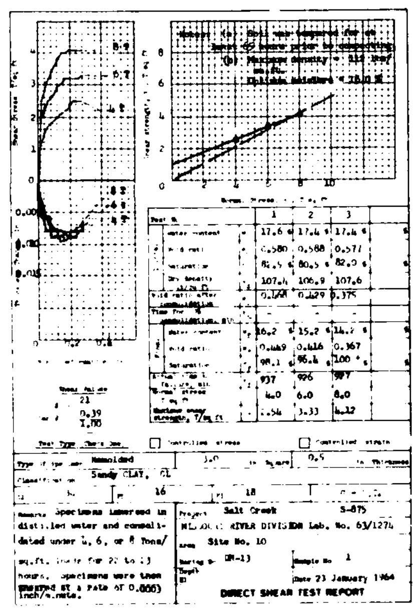


FIGURE 7

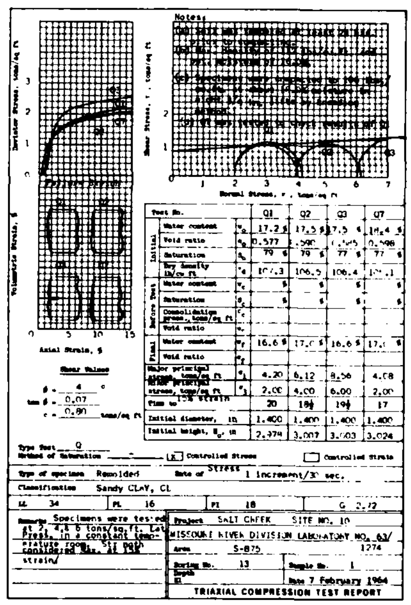


FIGURE 8

THIS DRAWING HAS BEEN REDUCED TO THREE-EIGHTHS THE ORIGINAL SCALE.

SOIL CLASSIFICATION RECORD SHEET

Salt-Wahoo Site 10 — 63/1274

Sample							Classification
							MIL. Std. 619 - June 1960
Composite of Holes 1, 2, and 12	47	26	99	97	100		Lean clay — CL
Composite of Holes 1, 2, and 12	49	28	84	98	100		Lean clay — CL
Hole 18	28	14	11	42	88	[illegible]	Clayey sand — SC-SM
Hole 18	40	23	97	99	100		Lean clay — CL

TABLE 2

DATE	DESCRIPTION	MADE	APPR'D

REVISIONS

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

SALT CREEK AND ITS TRIBUTARIES, NEBRASKA

DAM AND RESERVOIR, SITE 10

EMBANKMENT SOIL TEST DATA

DESIGNED BY: A. M. D.
DRAWN BY: E. C. V.
TRACED BY: E. C. V.
CHECKED BY: C. W. K.
SUBMITTED BY: [signature]
APPROVED: [signature]
APPROVED: [signature] DATE: APRIL 1964
APPROVED: [signature] — COL. C.E., DISTRICT ENGINEER
SCALE: AS SHOWN

SAFETY PAYS

THIS PLAN ACCOMPANIES CONTRACT NO. DA-25-066-eng- , MODIFICATION NO.

CORPS OF ENGINEERS

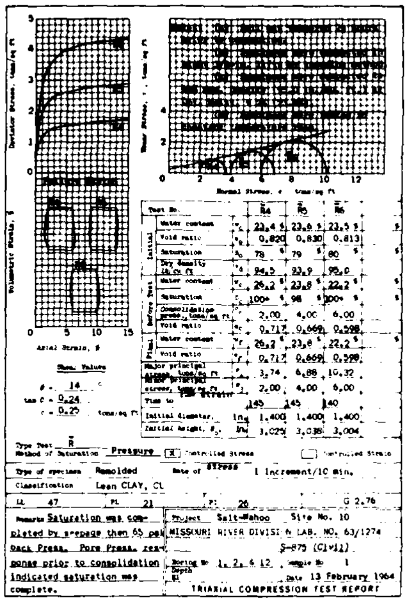


FIGURE 1

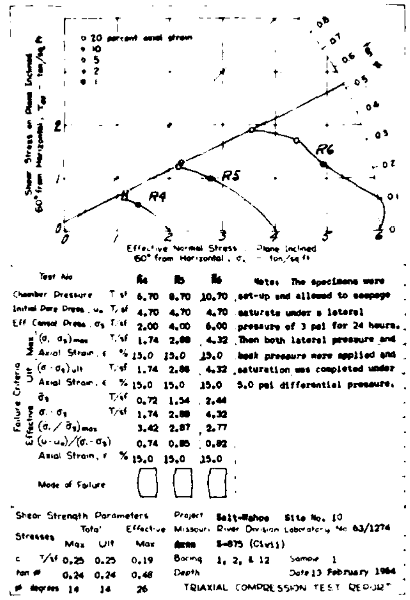


FIGURE 2

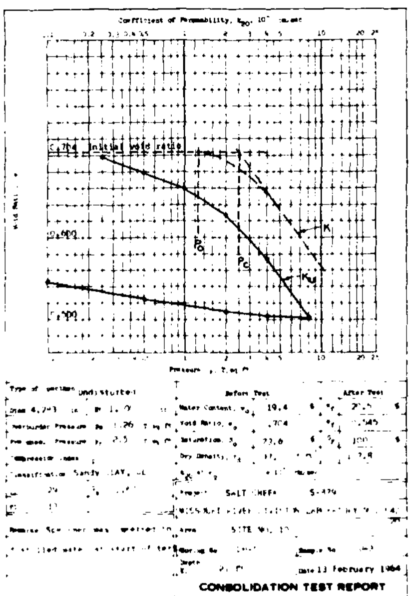


FIGURE 5

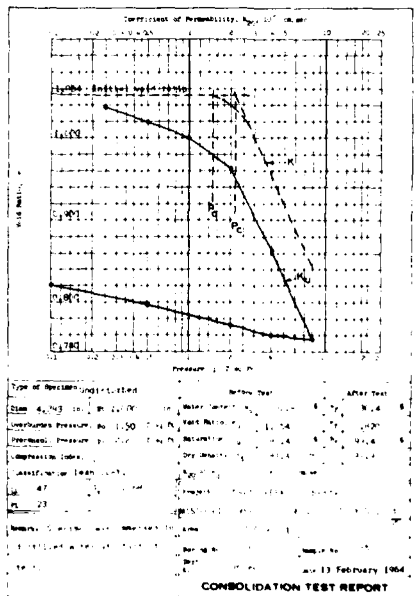
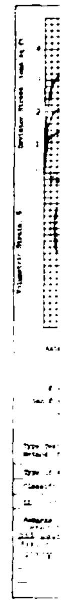
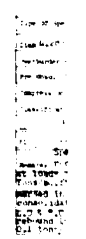


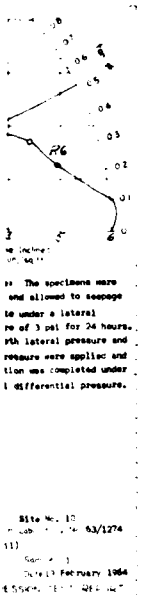
FIGURE 6





A 105 Micro-master Film or A Paper Reproducible Record Copy Must Be Made Before Every Addendum and/or Modification

ADDENDA NO.	DATE	MODIFICATION	DATE



The specimens were
and allowed to seepage
to under a lateral
re of 3 psi for 24 hours.
rth lateral pressure and
ressure were applied and
tion was completed under
l differential pressure.

Site No. 10
63/1274
February 1964

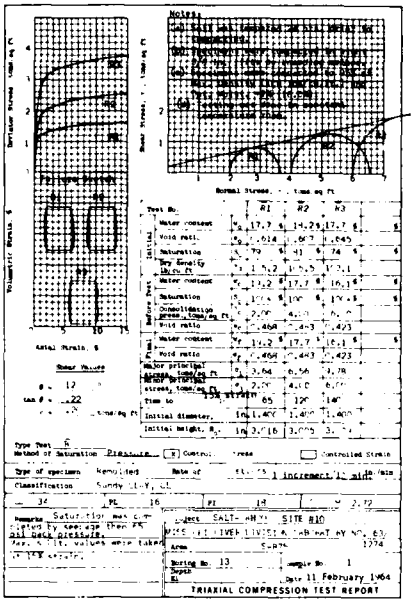


FIGURE 3

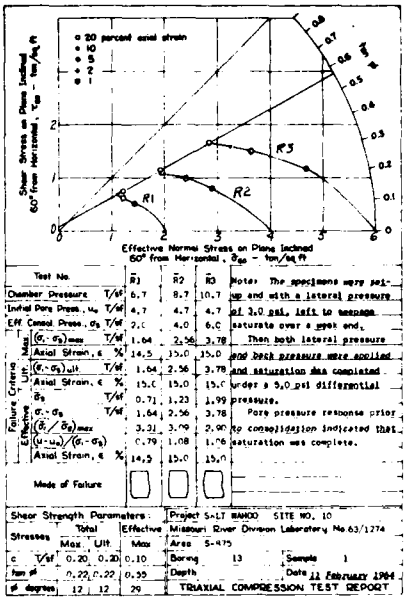
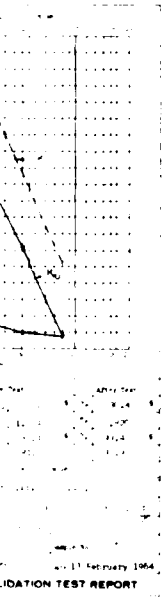


FIGURE 4



11 February 1964
IDATION TEST REPORT
6

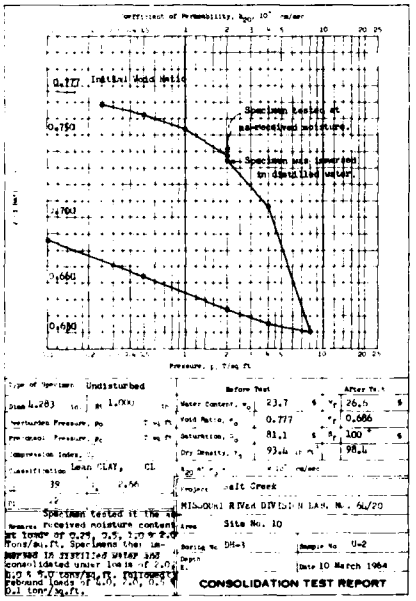


FIGURE 7

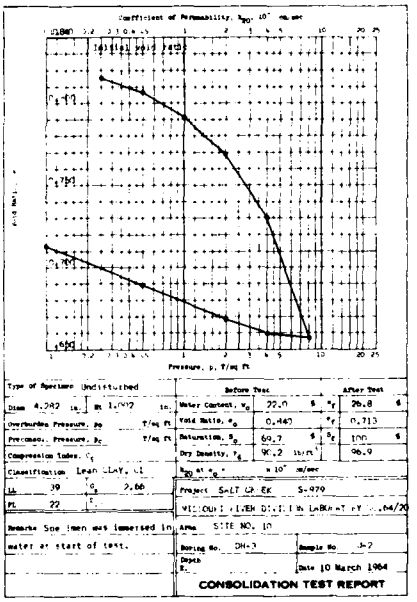


FIGURE 8

DATE	DESCRIPTION	MADE	APPR'D
	REVISIONS		

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

DESIGNED BY: A M D
DRAWN BY: E C V
TRACED BY: E C V
CHECKED BY: C W H

SALT CREEK AND ITS TRIBUTARIES, NEBRASKA

DAM AND RESERVOIR, SITE 10
EMBANKMENT SOIL TEST DATA AND
FOUNDATION CONSOLIDATION TESTS

APPROVED: Charles L. Hopp
DATE: APRIL 1964

APPROVED: Harold J. St. Clair
COL., CE, DISTRICT ENGINEER

SCALE: AS SHOWN

DRAWING NUMBER

SHEET

THIS DRAWING WAS BEEN REDUCED TO THREE-EIGHTHS THE ORIGINAL SCALE.

SAFETY PAYS

THIS PLAN ACCOMPANIES CONTRACT No. DA-25-066-eng- , MODIFICATION No.

EMBANKMENT CRITERIA AND PERFORMANCE REPORT (1981) PLATE A12

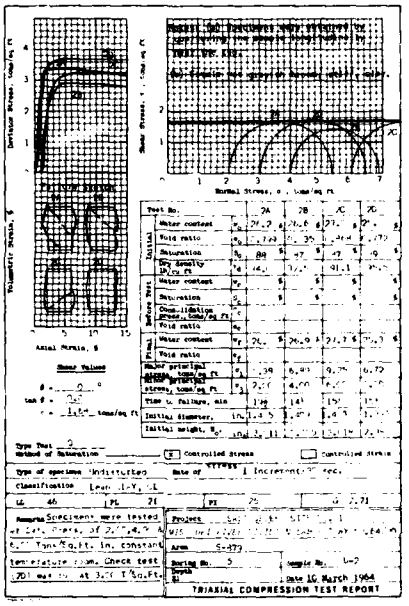


FIGURE 1

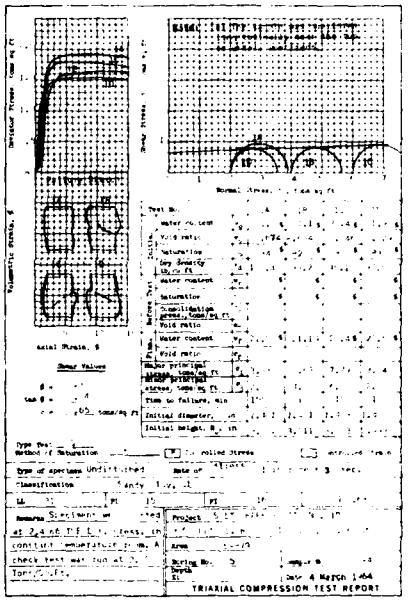


FIGURE 2

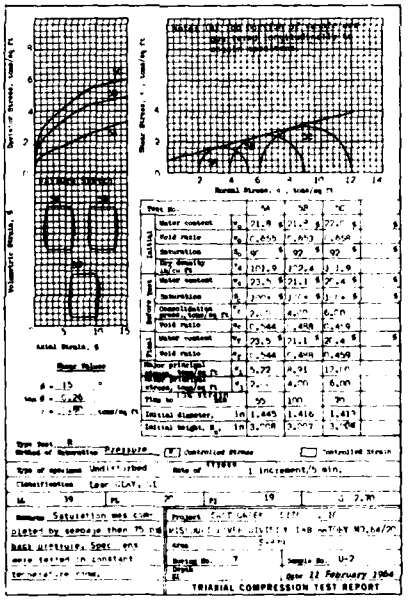


FIGURE 4

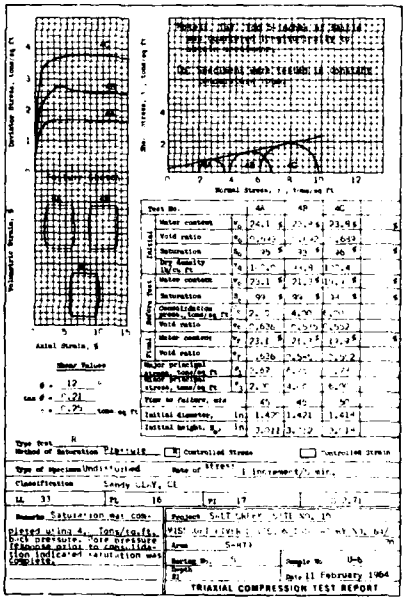


FIGURE 5

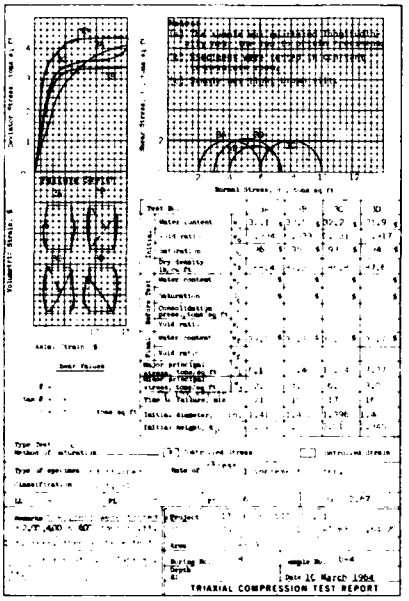


FIGURE 3

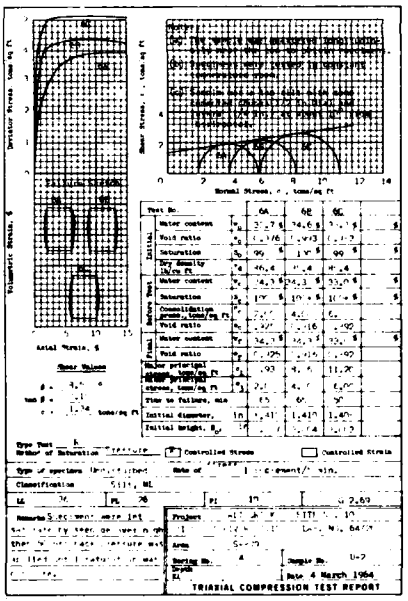


FIGURE 6

THIS DRAWING HAS BEEN REDUCED TO THREE-EIGHTHS THE ORIGINAL SCALE.

DATE	DESCRIPTION	MADE	APPD
	REVISIONS		

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

DESIGNED BY: A M D
DRAWN BY: E C V
TRACED BY: E C V
CHECKED BY: C W H

SALT CREEK AND ITS TRIBUTARIES, NEBRASKA

DAM AND RESERVOIR, SITE 10

FOUNDATION SOIL TEST DATA

APPROVED: Charles L. Hopp — DATE: APRIL 1964

APPROVED: Harold J. McClay — SCALE: AS SHOWN

CHIEF, ENGINEERING DIVISION — DRAWING REVISED

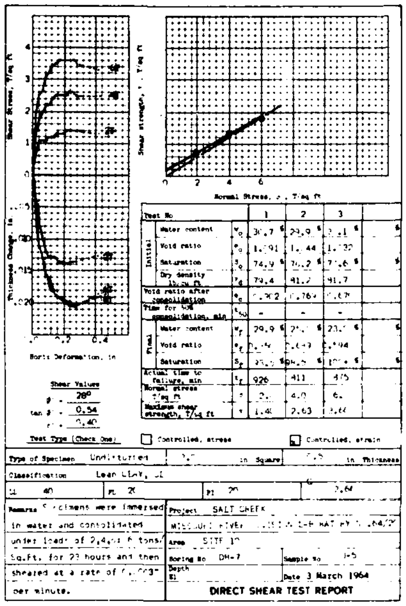
DIV. ENGINEER — SHEET

THIS PLAN ACCOMPANIES CONTRACT NO. DA-25-066-eng- , MODIFICATION NO.

EMBANKMENT CRITERIA AND PERFORMANCE REPORT (1981) PLATE A13

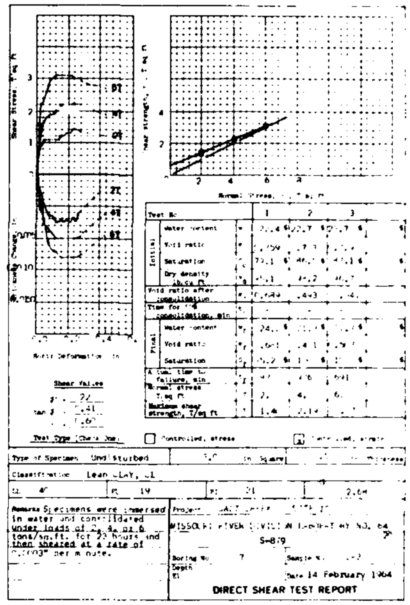
12

CORPS OF ENGINEERS



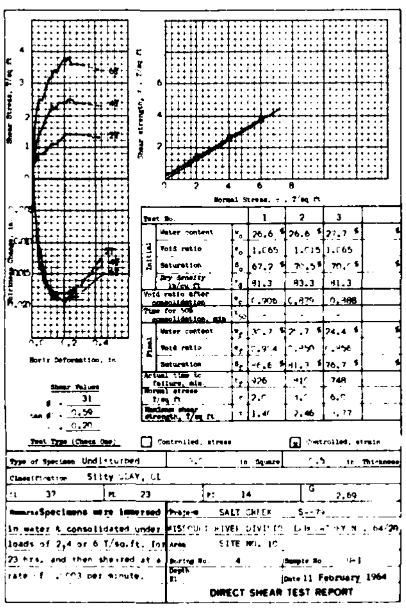
Shear Stress, T/sq ft
Thickness Change, in
Horiz Deformation, in
Shear strength, τ, T/sq ft
Normal Stress, σ, T/sq ft
Shear Values
φ = 28°
tan φ = 0.54
c = 0.40
Test No. 1 2 3
Initial: Water content; Void ratio; Saturation; Dry density lb/cu ft
Void ratio after consolidation
Time for 50% consolidation, min
Final: Water content; Void ratio; Saturation
Actual time to failure, min 926 411 475
Normal stress T/sq ft
Maximum shear strength, T/sq ft
Test Type (Check One) Controlled, stress Controlled, strain
Type of Specimen Undisturbed
Classification Lean CLAY, CL
Remarks Specimens were immersed in water and consolidated under loads of 2,4, or 6 tons/sq.ft. for 23 hours and then sheared at a rate of 0.003" per minute.
Project SALT CREEK
Area SITE 10
Boring No. DH-7
Date 3 March 1964
DIRECT SHEAR TEST REPORT

FIGURE 1



Shear Stress, T/sq ft
Thickness Change, in
Horiz Deformation, in
Normal Stress, σ, T/sq ft
Shear Values
Test No. 1 2 3
Initial: Water content; Void ratio; Saturation; Dry density lb/cu ft
Void ratio after consolidation
Time for 50% consolidation, min
Final: Water content; Void ratio; Saturation
Actual time to failure, min
Normal stress T/sq ft
Maximum shear strength, T/sq ft
Test Type (Check One) Controlled, stress Controlled, strain
Type of Specimen Undisturbed
Classification Lean CLAY, CL
Remarks Specimens were immersed in water and consolidated under loads of 2, 4, or 6 tons/sq.ft. for 23 hours and then sheared at a rate of 0.003" per minute.
MISSOURI RIVER DIVISION
S-879
Date 14 February 1964
DIRECT SHEAR TEST REPORT

FIGURE 2



Shear Stress, T/sq ft
Thickness Change, in
Horiz Deformation, in
Shear strength, τ, T/sq ft
Normal Stress, σ, T/sq ft
Shear Values
φ = 31
tan φ = 0.59
c = 0.20
Test No. 1 2 3
Initial: Water content 26.6 26.6 27.7; Void ratio 1.065 1.015 1.065; Saturation; Dry density lb/cu ft 81.3 83.3 81.3
Void ratio after consolidation
Time for 50% consolidation, min
Final: Water content; Void ratio; Saturation
Actual time to failure, min 926 748
Normal stress T/sq ft
Maximum shear strength, T/sq ft
Test Type (Check One) Controlled, stress Controlled, strain
Type of Specimen Undisturbed
Classification Silty CLAY, CL
Remarks Specimens were immersed in water & consolidated under loads of 2,4 or 6 T/sq.ft. for 23 hrs. and then sheared at a rate of 0.003 per minute.
Project SALT CREEK
Area SITE NO. 10
Boring No. 4
Date 11 February 1964
DIRECT SHEAR TEST REPORT

FIGURE 5

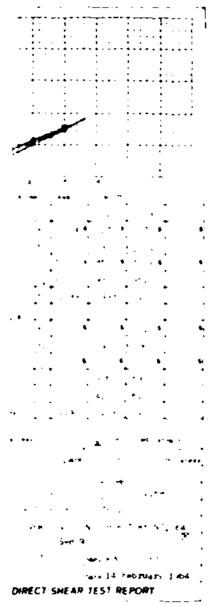
TABLE 1. - [illegible]

SALT CREEK, SITE #10

TEST REQUEST NO. S-879

Hole No.	Sample No.	Depth	Dry Density (lbs/cu.ft.)	Moisture (percent)	L/D (a)	Breaking Strength lbs/sq.in.	Breaking Strength Ton/sq.ft.	Atterberg Limits Liquid Limit	Atterberg Limits Plastic Limit
4	U-1	7.95-10.1	93.9	25.8	1.96	19.32	1.39	37	23
7	U-3	12.0-13.8	101.3	2?.1	2.02	17.87	1.?9	42	18
7	U-5	20.1-22.1	97.1	3?.7	1.9?	8.52	0.61	41	21
8	U-1	4.?-6.0	93.6	22.8	1.96	1?.70	0.77	49	21
8	U-2	14.9-17.0	97.8	25.3	2.05	19.?	1.37	4?	2?

Note: (a) L/D denotes length to diameter ratio of specimens.



[illegible] 2

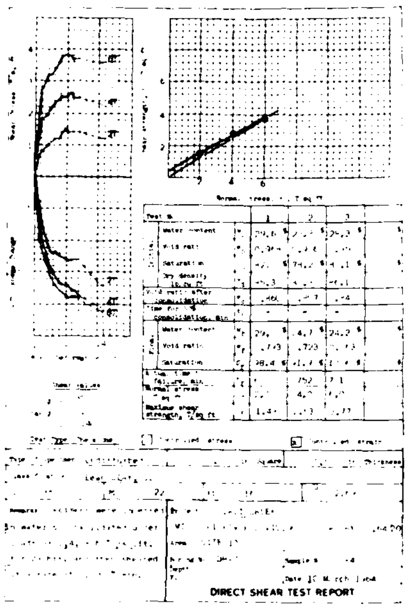


FIGURE 3

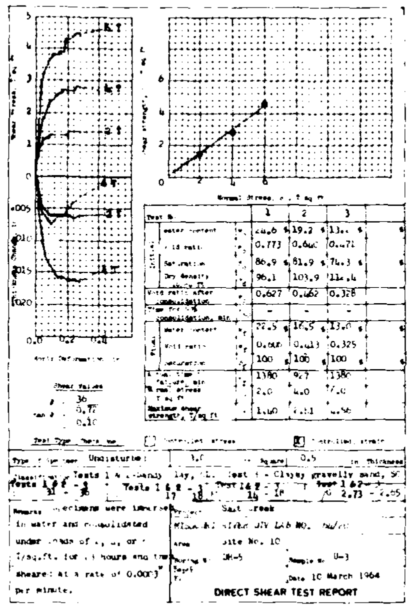


FIGURE 4

TABLE 1. - [illegible] COMPRESSION AND CLASSIFICATION TEST DATA

TEST [illegible] NO. S-879 [illegible] DIVISION [illegible] NO. 64/20

Density (lbs/cu.ft.)	Moisture (percent)	L/D (a)	Breaking Strength lbs/sq.in.	Breaking Strength Tons/sq.ft.	Atterberg Limits Liquid Limit	Atterberg Limits Plastic Limit	Classification	Failure Diagram	Remarks
[illegible]3.9	25.8	1.96	19.32	1.39	37	23	Silty CLAY, CL		Conical failure. Light brown silty clay. Sample contained small holes throughout and a vertical fault.
[illegible]1.3	2[illegible].1	2.02	17.87	1.[illegible]	42	19	Lean CLAY, CL		Columnar failure. Dark brown lean clay. Specimen contained some organic material throughout.
[illegible].1	3[illegible].7	1.9[illegible]	[illegible].52	0.61	41	21	Lean CLAY, CL		Conical failure. Dark brown lean clay. Specimen contained some small holes throughout.
[illegible].6	22.8	1.96	1[illegible].70	0.77	49	21	Lean CLAY, CL		Columnar failure. Dark brownish gray lean clay. Specimen contained some roots and rootlets throughout.
9[illegible]	[illegible]	2.0[illegible]	19.[illegible]	[illegible].37	[illegible]	2[illegible]	[illegible]		Conical failure. Brown lean clay. Specimen contained [illegible]

(a) [illegible]

THIS DRAWING HAS BEEN REDUCED TO THREE-EIGHTHS THE ORIGINAL SCALE.

DATE	DESCRIPTION	MADE	APPR'D

REVISIONS

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

DESIGNED BY: A M D
DRAWN BY: E C V
TRACED BY: E C V
CHECKED BY: C W H

SALT CREEK AND ITS TRIBUTARIES, NEBRASKA

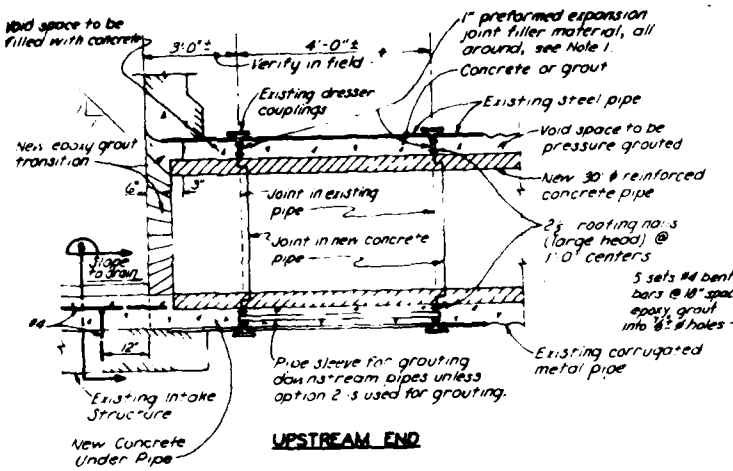
DAM AND RESERVOIR, SITE 10

FOUNDATION SOIL TEST DATA

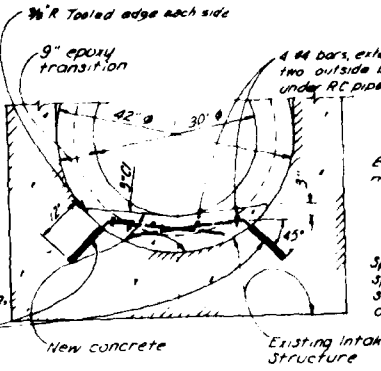
SUBMITTED BY: [signature] CHIEF EMB FDNS & G SECTION
APPROVED: [signature] CHIEF FDN & MTL'S BRANCH
APPROVED: Charles L. Hopp, CHIEF ENGINEERING DIVISION
DATE: APRIL 1964
APPROVED: Harold J. St. Clair, COL. C.E. DISTRICT ENGINEER
SCALE: AS SHOWN
SPEC. NO. [illegible]
DRAWING NUMBER
SHEET

THIS PLAN ACCOMPANIES CONTRACT No. DA-25-066-eng. MODIFICATION No.

2

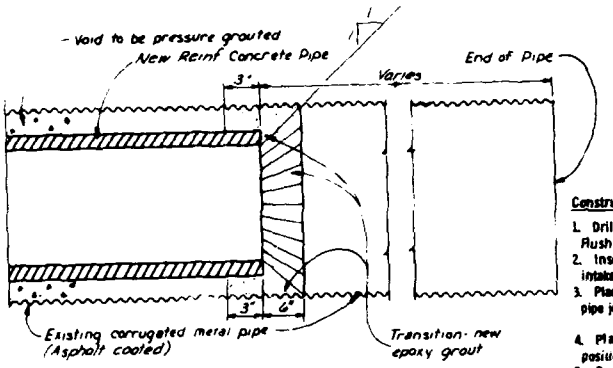


UPSTREAM END



SECTION (B)
NO SCALE

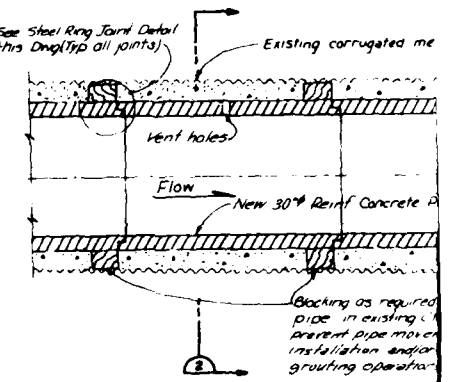
SECTION
NO SCA



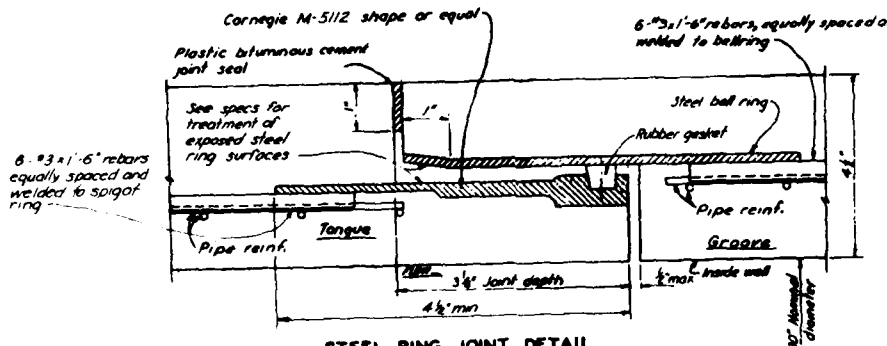
DOWNSTREAM END

Construction Procedure

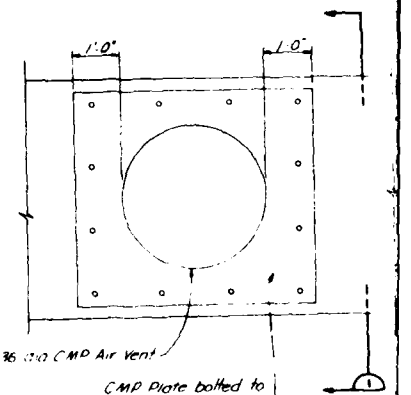
1. Drill holes and sandblast existing concrete in intake structure. Flush out debris.
2. Insert short upstream length of pipe in conduit and store in intake structure.
3. Place 4 foot length of pipe so that ends of pipe line up with steel pipe joints. Position pipe sleeve as shown on drawing.
4. Place concrete or grout around the 4 foot long concrete pipe and position preformed joint filler at both ends of pipe.
5. Position short upstream length of pipe and fill void space outside of pipe and place concrete in base of intake structure.
6. Install downstream concrete pipe sections and grout void space between new concrete pipe and old corrugated metal pipe.
7. Place new epoxy grout transition sections at upstream and downstream ends of new concrete pipe.



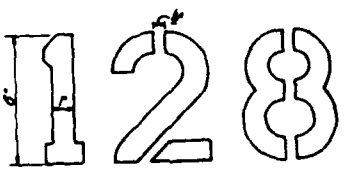
TYPICAL LONGITUDINAL SECTIO
NO SCALE



STEEL RING JOINT DETAIL
NO SCALE



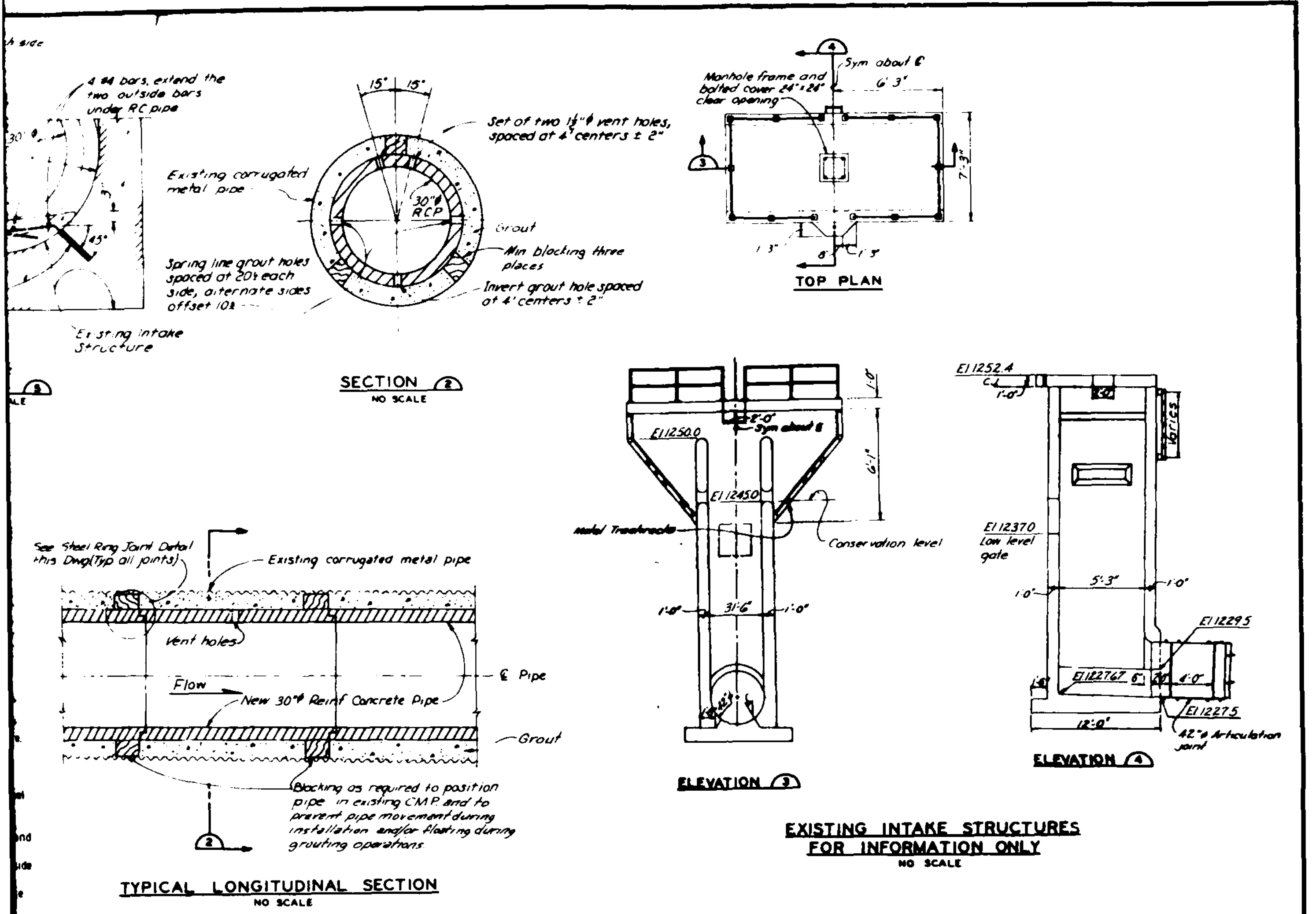
PLAN

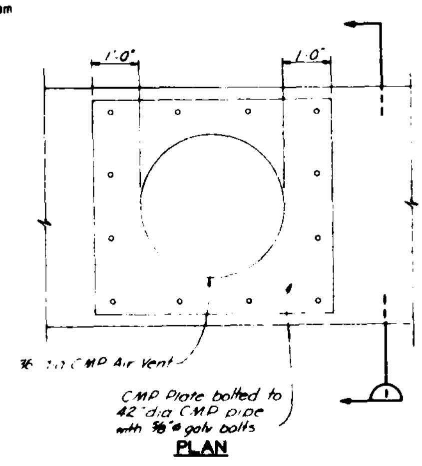


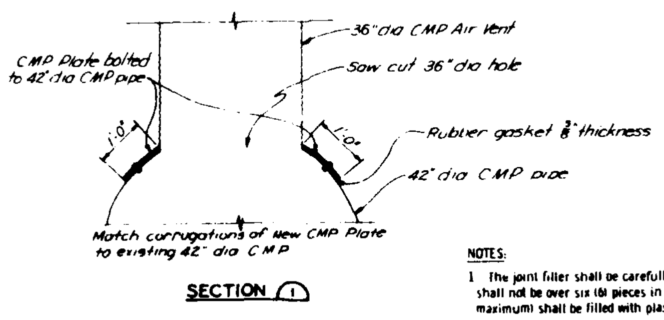
TYPICAL PIPE NUMBERS

NOTE:

Permanent numbers to be painted on inside face of each concrete pipe section. Pipe sections are to be numbered consecutively starting at downstream end. Numbers are to be located at 2 o'clock position looking upstream.


4 #4 bars, extend the two outside bars under RC pipe
15°
15°
Set of two 1½"ϕ vent holes, spaced at 4' centers ± 2"
Existing corrugated metal pipe
30"ϕ RCP
Grout
Min blocking three places
Spring line grout holes spaced at 20' each side, alternate sides offset 10'
Invert grout hole spaced at 4' centers ± 2"
Existing intake Structure
SECTION 2
NO SCALE
Sym about ℄
Manhole frame and bolted cover 24"x24" clear opening
6' 3"
7'-3"
TOP PLAN
El 1252.4
El 1250.0
Sym about ℄
El 1245.0
Metal Trashracks
Conservation level
El 1237.0
Low level gate
5'-3"
1'-0"
31'-6"
El 1229.5
El 1227.5
42"ϕ Articulation joint
12'-0"
ELEVATION 3
ELEVATION 4
EXISTING INTAKE STRUCTURES FOR INFORMATION ONLY
NO SCALE
See Steel Ring Joint Detail this Dwg (Typ all joints)
Existing corrugated metal pipe
Vent holes
Flow
New 30"ϕ Reinf Concrete Pipe
℄ Pipe
Grout
Blocking as required to position pipe in existing CMP and to prevent pipe movement during installation and/or floating during grouting operations
TYPICAL LONGITUDINAL SECTION
NO SCALE





NOTES:

1. The joint filler shall be carefully cut with a power saber saw on a table and there shall not be over six (6) pieces in each joint. Small variations in fit (1/2-inch maximum) shall be filled with plastic bituminous cement.

NOTE:

The Contractor removed a section of the existing 42"dia. CMP and fabricated the 36" dia. air vent to a new section of 42"dia. CMP. The new 42"dia. CMP and new coupling bands were fabricated to the same details as the existing pipe with the exception that two 3/8" thick by 12" wide rubber gaskets were used under the coupling at each new joint in 42"CMP. Shaped and compacted gravel or crushed rock bedding was placed below the new section of CMP and coupling bands.

AIR VENT CONNECTION

SCALE ⅜ INCH = 1 FOOT

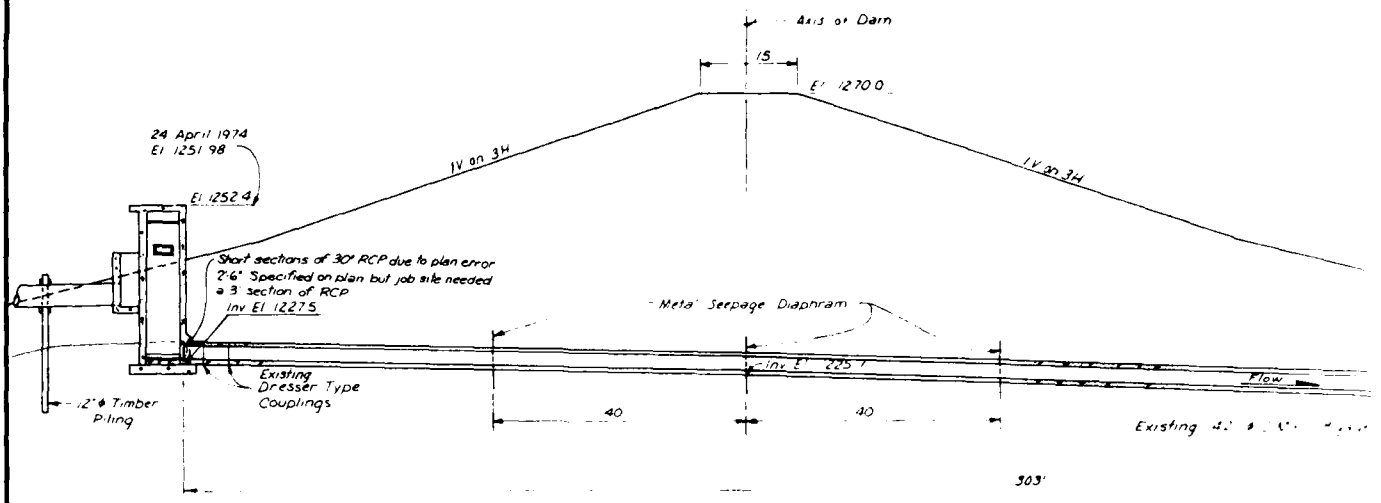
THIS DRAWING HAS BEEN REDUCED TO THREE-EIGHTHS THE ORIGINAL SCALE.

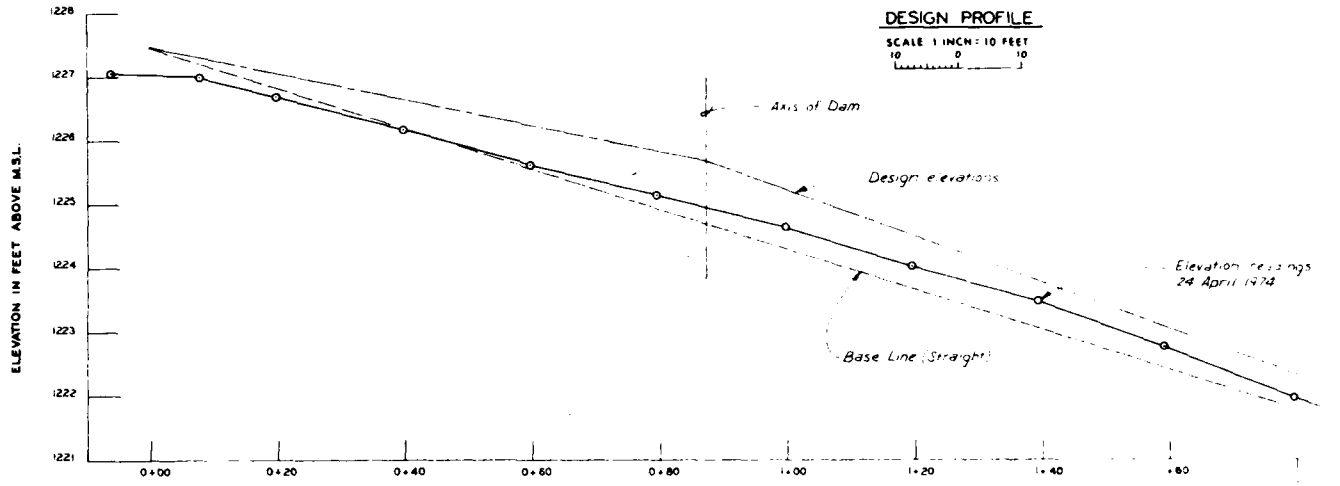
U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

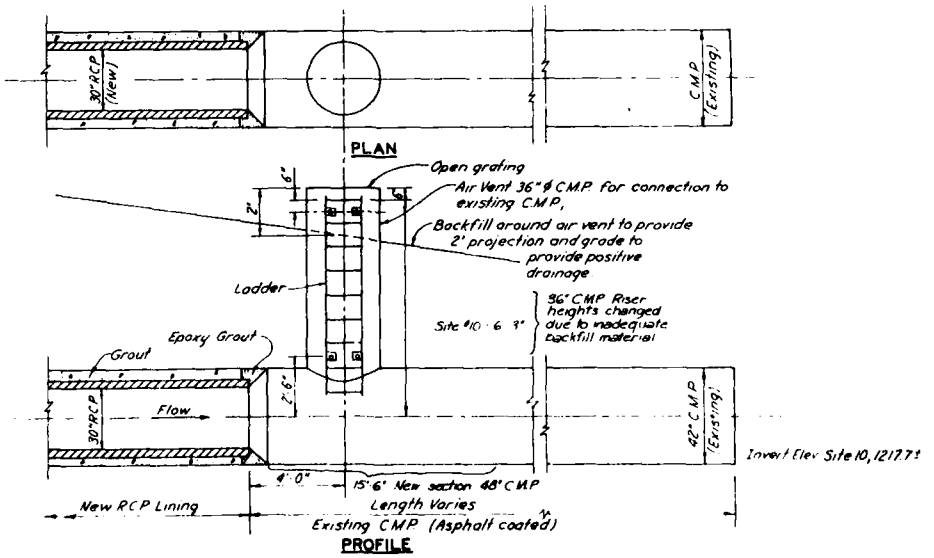
SALT CREEK AND ITS TRIBUTARIES, NEBRASKA
YANKEE HILL DAM AND LAKE
SITE NO.10

CONDUIT REHABILITATION

MSC26-61E6



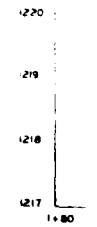




DOWNSTREAM END OF OUTLET WORKS

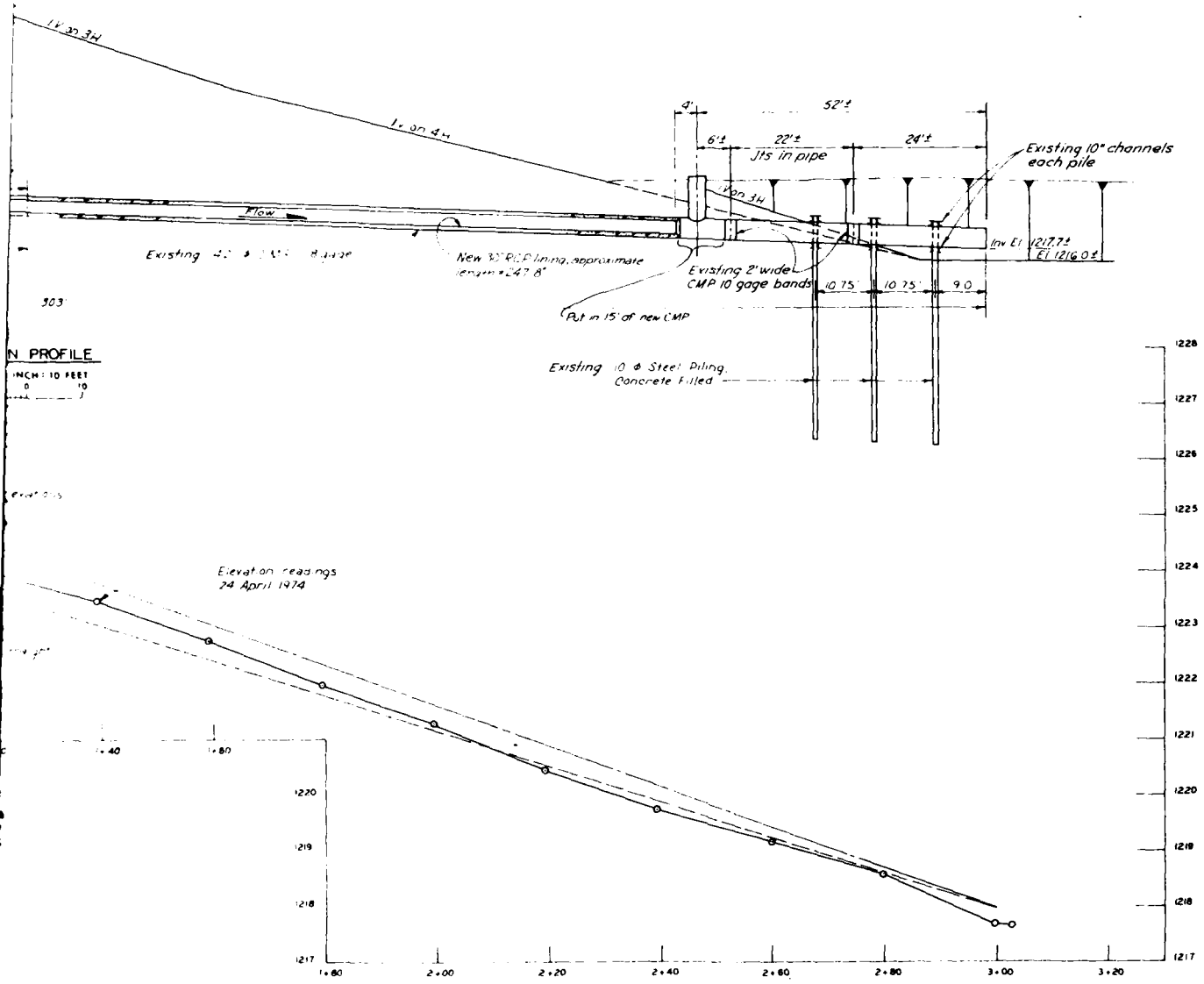
SCALE $\frac{3}{8}$ INCH = 1 FOOT

12' 0 2' 4' 6'



SETTLE

CINVERT EL



SETTLEMENT PROFILE
(INVERT ELEVATION READINGS)

Elev Site 10, 1217.7±

THIS DRAWING HAS BEEN REDUCED TO THREE-EIGHTHS THE ORIGINAL SCALE.

DATE	DESCRIPTION	MADE	APPR'D
22 APR 80	REVISED TO SHOW AS BUILT CONDITIONS	GCS	JJG

REVISIONS

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

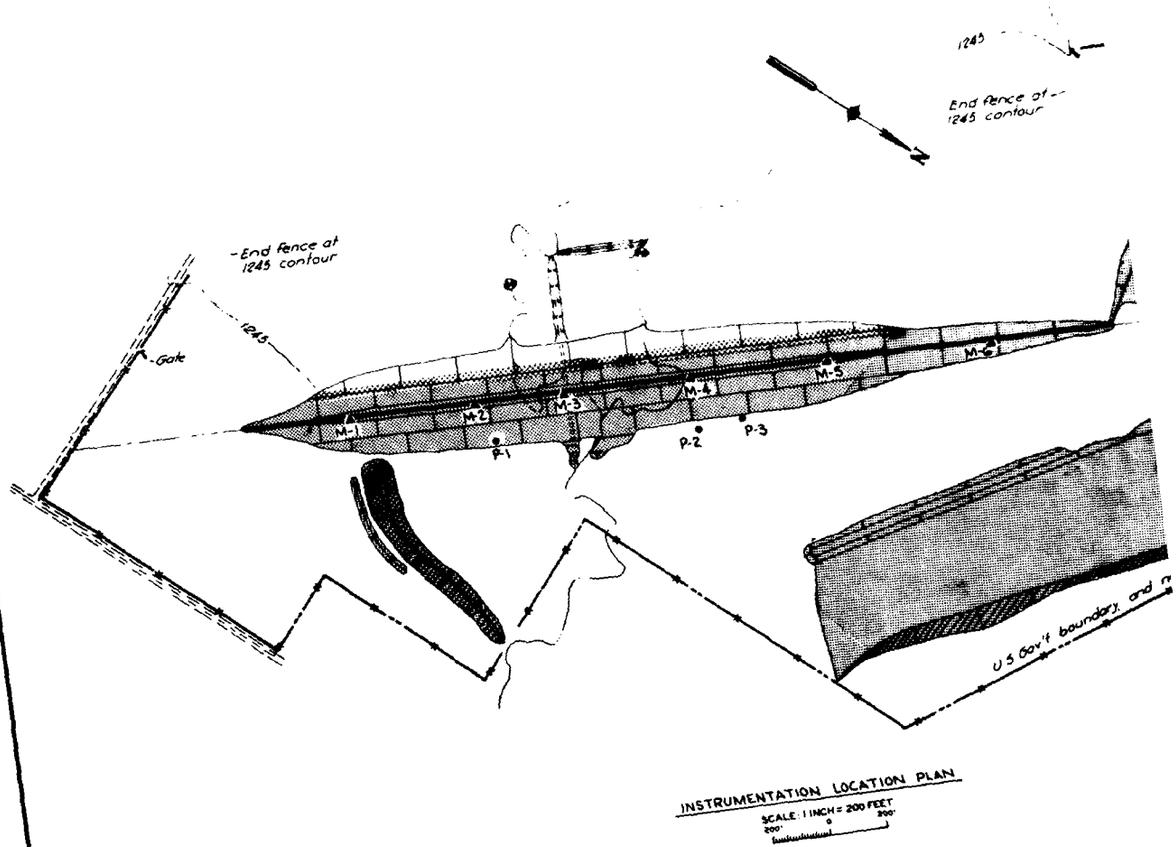
DESIGNED BY: E.R.J.
DRAWN BY:
CHECKED BY: M.L.P.
SUBMITTED BY:
CHIEF, DIV. OR BR.

SALT CREEK AND ITS TRIBUTARIES, NEBRASKA
SALT CREEK DAMS AND LAKES
OUTLET WORKS REHAB.-PHASE IV
SITE 10
YANKEE HILL DAM AND LAKE
CONDUIT PROFILE AND SURVEY

RECOMMENDED: C. Burnham, CHIEF, DESIGN BRANCH
APPROVED: [signature], CHIEF, ENGINEERING DIVISION
DATE: FEB 1980
APPROVED: [signature], COL., U.S., DISTRICT ENGINEER
SCALE: AS SHOWN
CONTRACT NO. DACW45-80-C-0051
DRAWING NUMBER: MSC27-61E4
SHEET

THIS PLAN ACCOMPANIES CONTRACT No. DACW45-80-C-0051 MODIFICATION No.

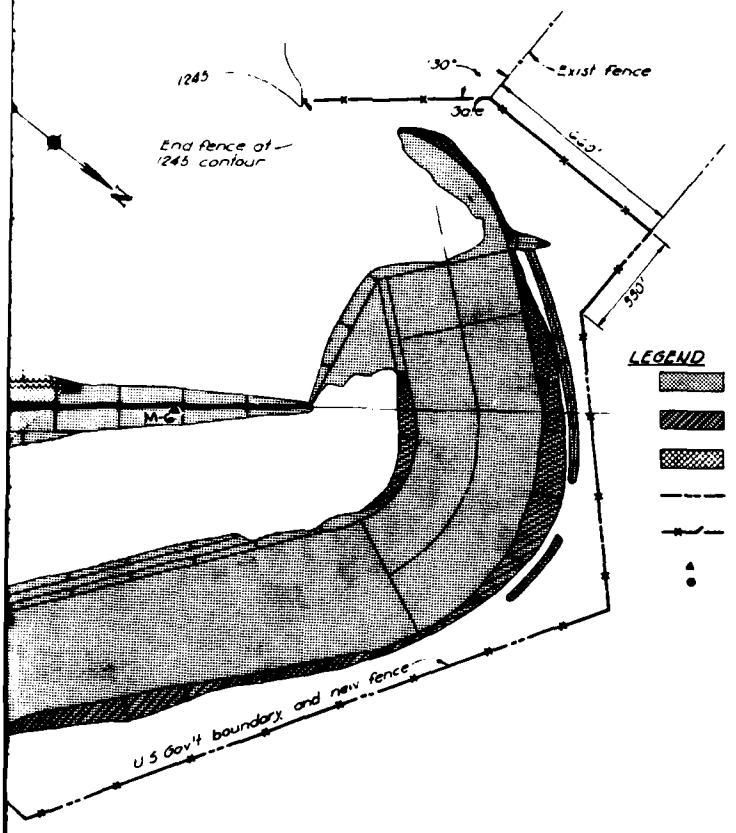
SAFETY PAYS



INSTRUMENTATION LOCATION PLAN

SCALE: 1 INCH = 200 FEET

200' 0 200'



N PLAN

LEGEND

- Seeding, see note
- Topsoil of excavated slopes and seeding
- Embankment stone protection
- U.S. Gov't boundary
- Fence and gate this contract
- ▲ Crest Movement Markers
- ● Open Tube Piezometers

THIS DRAWING HAS BEEN REDUCED TO THREE-EIGHTHS THE ORIGINAL SCALE.

NO.	DESCRIPTION	MADE	APPD
	REVISIONS		

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

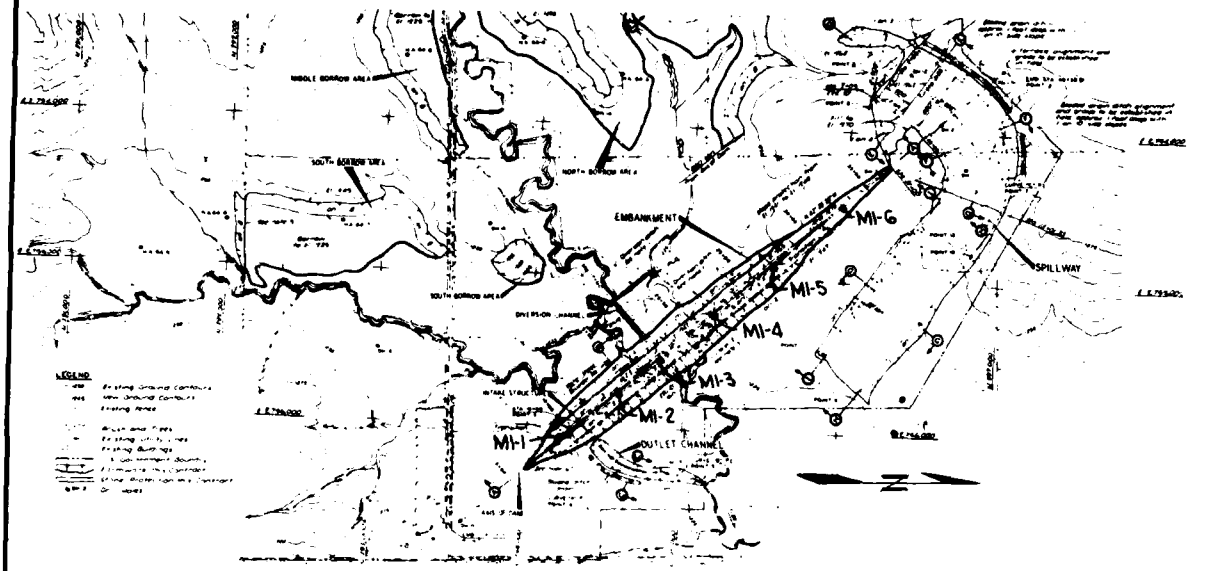
SALT CREEK AND ITS TRIBUTARIES, NEBRASKA
YANKEE HILL DAM AND LAKE
SITE NO. 10
INSTRUMENTATION LOCATION PLAN

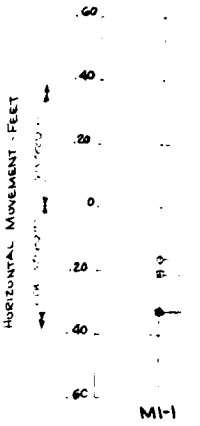
SCALE: AS SHOWN
DACA45

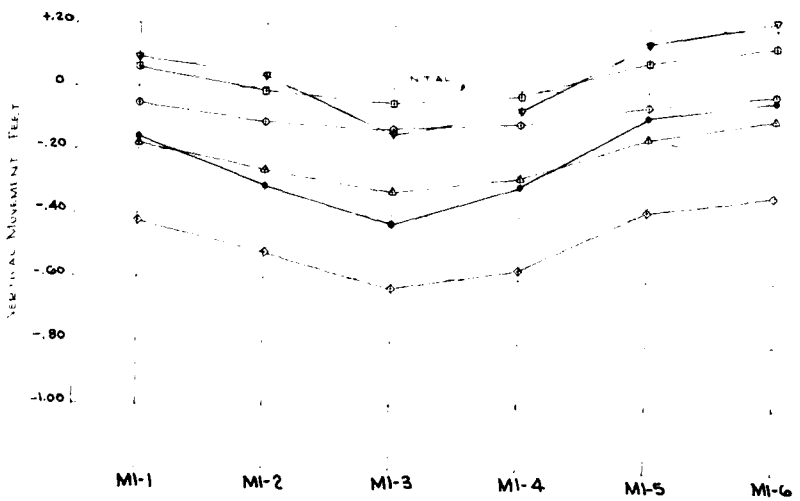
THIS PLAN ACCOMPANIES CONTRACT NO. DACA45 MODIFICATION NO.

SAFETY PAYS

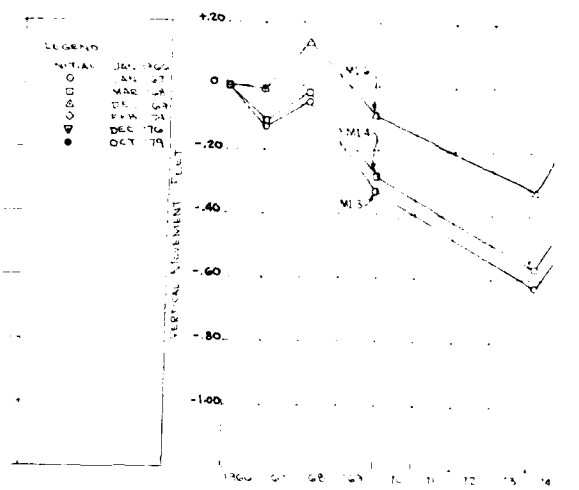
$$ – THINK VALUE ENGINEERING – $$



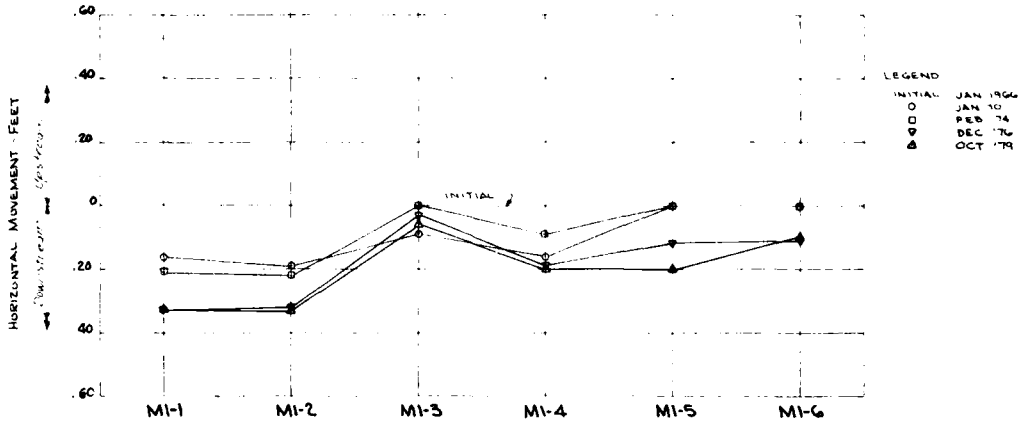




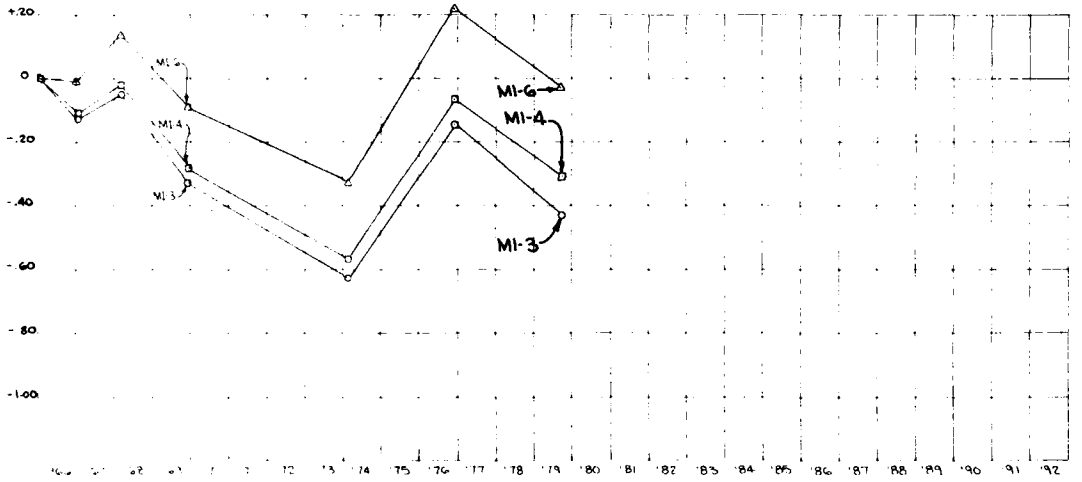
EMBANKMENT VERTICAL MOVEMENT



EM



EMBANKMENT HORIZONTAL MOVEMENT



EMBANKMENT VERTICAL MOVEMENT VS. TIME

THIS DRAWING HAS BEEN REDUCED TO THREE-EIGHTHS THE ORIGINAL SCALE.

NOTE: REFERENCE AT EACH END OF THE DAM WERE ESTABLISHED IN 1975.

DATE	DESCRIPTION	MADE	APP'D
	REVISIONS		

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

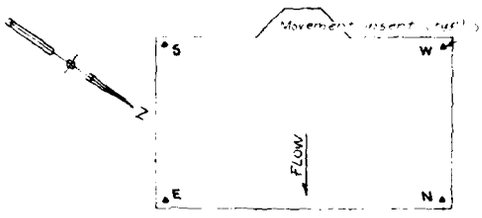
SALT CREEK, NEBRASKA
SITE 10
YANKEE HILL DAM
EMBANKMENT MOVEMENT INSERTS
HORIZONTAL AND VERTICAL MOVEMENTS

SCALE AS SHOWN

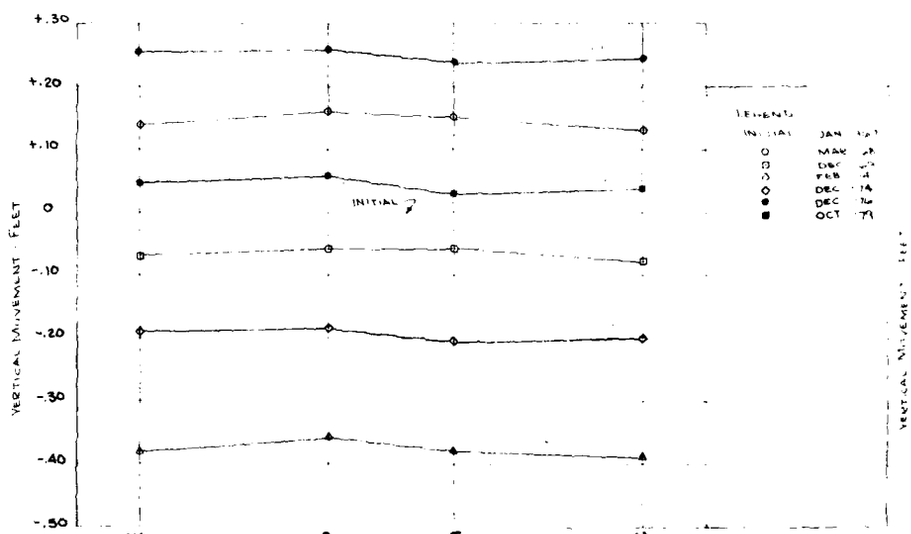
THIS PLAN ACCOMPANIES CONTRACT No.
MODIFICATION No.

SAFETY PAYS

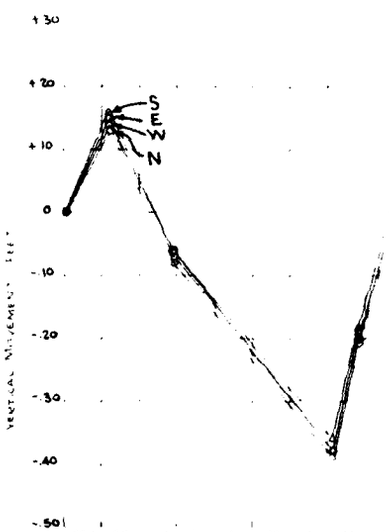
EMBANKMENT CRITERIA AND PERFORMANCE REPORT (1981) PLATE A18

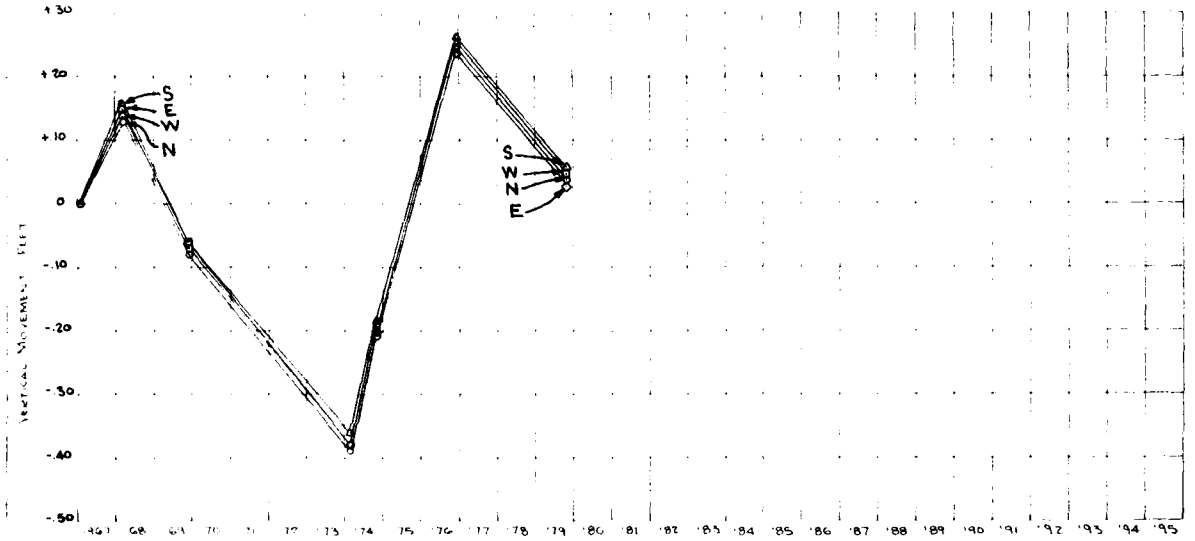


INTAKE STRUCTURE - PLAN



VERTICAL MOVEMENT -
INTAKE STRUCTURE





VERTICAL MOVEMENT VS. TIME
INTAKE STRUCTURE

THIS DRAWING HAS BEEN REDUCED TO THREE-EIGHTHS THE ORIGINAL SCALE.

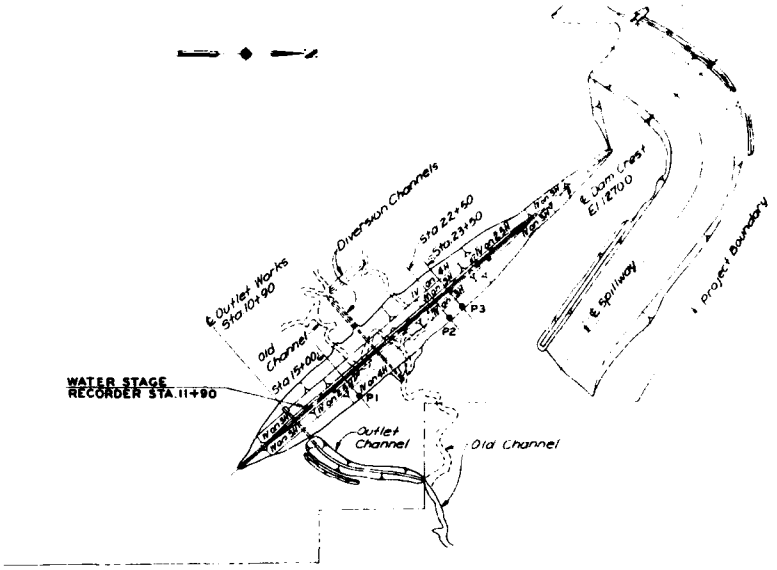
DATE	DESCRIPTION	MADE	APPR'D
	REVISIONS		

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

SALT CREEK, NEBRASKA
SITE 10
YANKEE HILL DAM
INTAKE STRUCTURE - VERTICAL MOVEMENT

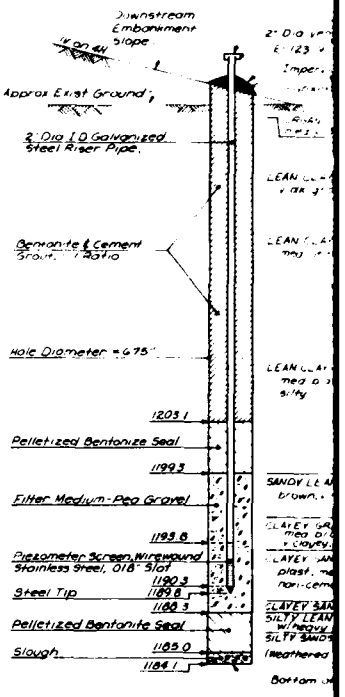
SAFETY PAYS

THIS PLAN ACCOMPANIES CONTRACT No.
MODIFICATION No.



DAM SITE 10 PLAN

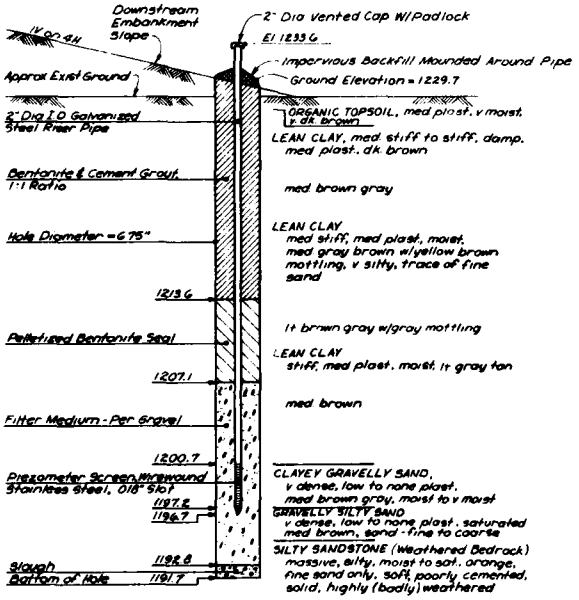
SCALE 1 INCH = 400 FEET



PIEZOMETER NO. 1

STA. 15+00

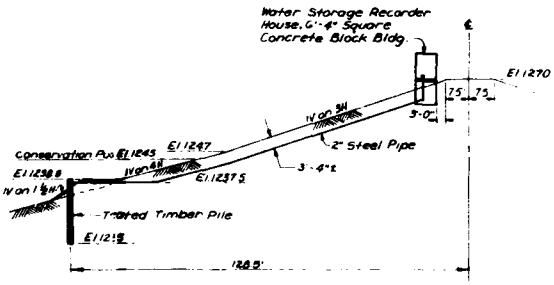
SCALE VERT 1 INCH = 5 FEET
HORIZ 1 INCH = NONE FEET



PIEZOMETER NO. 3

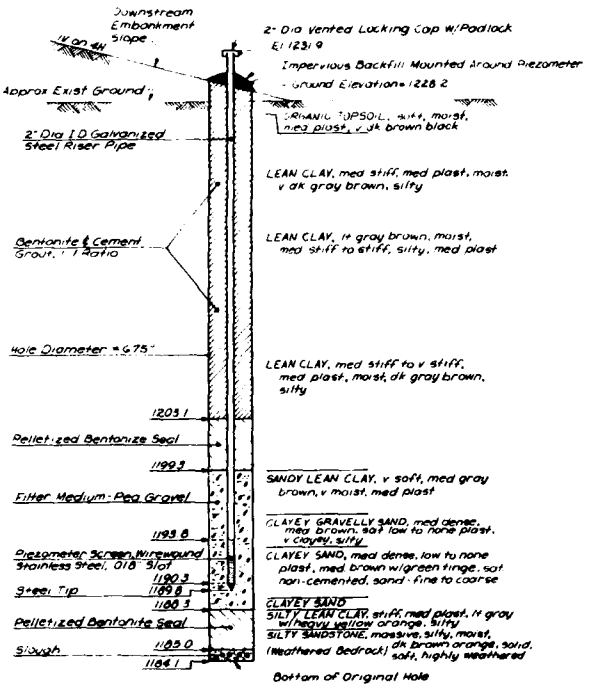
STA. 23+50

SCALE VERT 1 INCH = 5 FEET
HORIZ 1 INCH = NONE FEET



WATER STAGE RECORDER

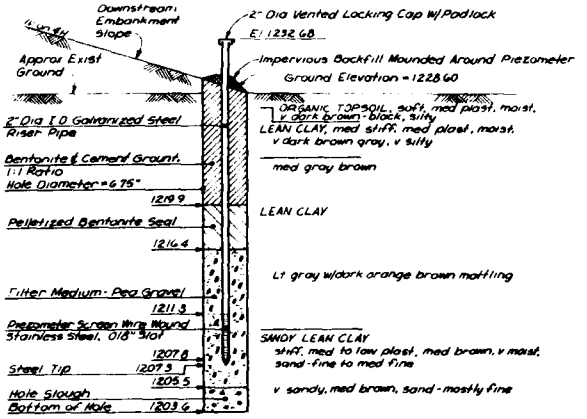
SCALE 1 INCH 20 FEET



PIEZOMETER NO. 1

STA 15+00

SCALE VERT 1 INCH = 5 FEET
HORIZ 1 INCH = NONE FEET



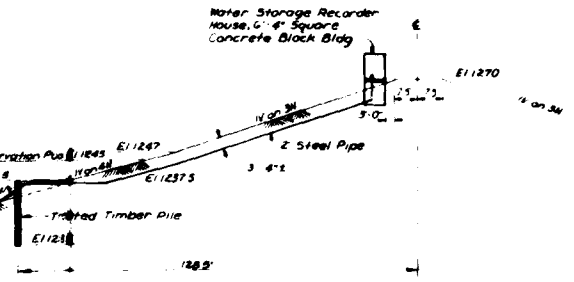
PIEZOMETER NO. 2

STA. 22+50

SCALE VERT 1 INCH = 5 FEET
HORIZ 1 INCH = NONE FEET

NOTES

1. See Plate A21 for plots of piezometer readings.
2. See Plate A22 for water stage recorder details.
3. Piezometers installed in June of 1981.



WATER STAGE RECORDER

SCALE INCH = 2' FEET

THIS DRAWING HAS BEEN REDUCED TO HALF SIZE. DIMENSIONS ARE FOR ORIGINAL SCALE.

DATE	DESCRIPTION	INITIALS	APPVD
	REVISIONS		

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

SALT CREEK AND ITS TRIBUTARIES, NEBRASKA

YANKEE HILL DAM AND LAKE SITE NO. 10

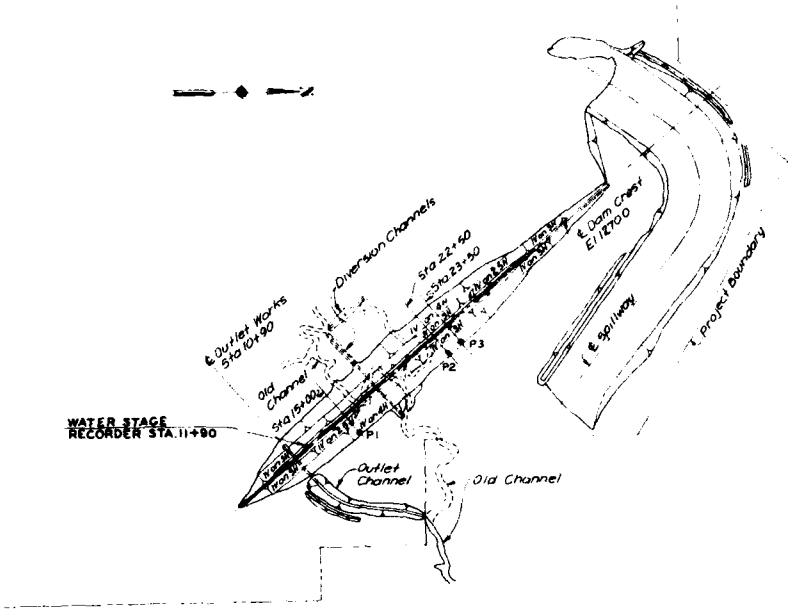
PIEZOMETER INSTALLATION AND WATER STAGE RECORDER

DESIGNED BY
DRAWN BY W.W.
CHECKED BY
QUANTITIES BY
SUBMITTED
RECOMMENDED
APPROVED
DATE
SCALE AS SHOWN
DRG. NO. DACA45
SHEET

THIS PLAN ACCOMPANIES CONTRACT NO. DACA45-
DATED
MODIFICATION NO.

SAFETY DAY

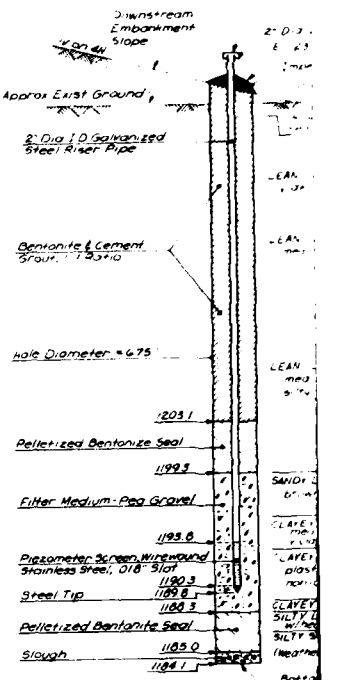
$$ – THINK VALUE ENGINEERING – $$



DAM SITE 10 PLAN

SCALE 1 INCH = 400 FEET

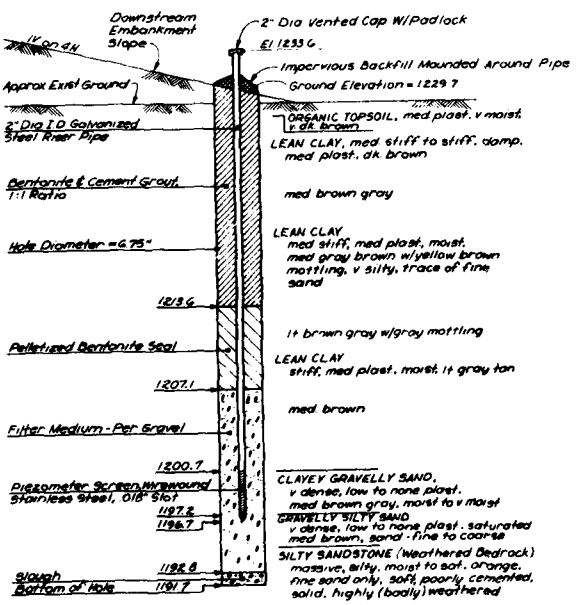
400' 0 400'



PIEZOMETER NO.

STA 15+00

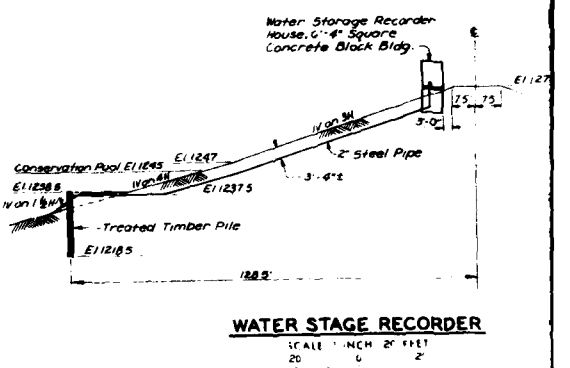
SCALE VERT 1 INCH = 5
HORIZ 1 INCH = NONE



PIEZOMETER NO. 3

STA. 23+50

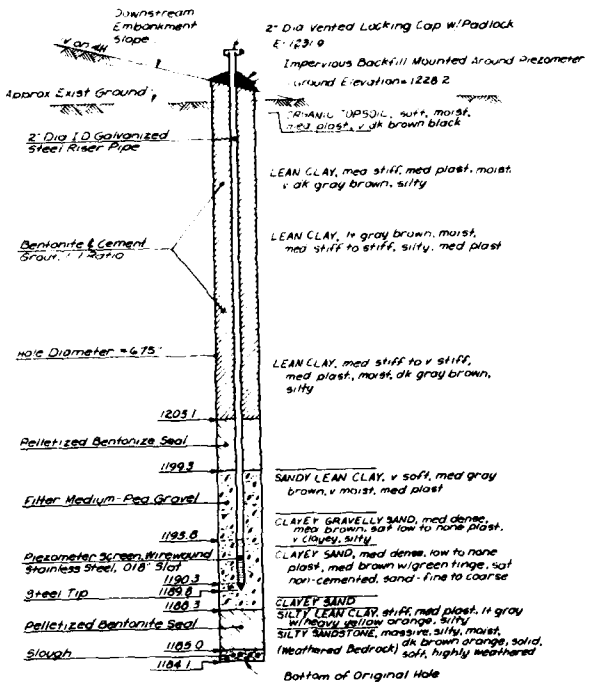
SCALE VERT 1 INCH = 5 FEET
HORIZ 1 INCH = NONE FEET



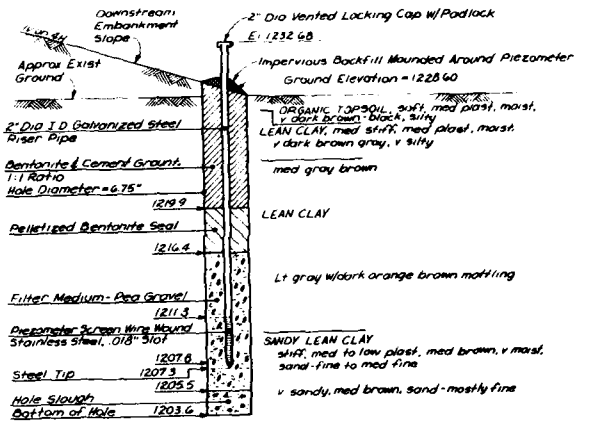
WATER STAGE RECORDER

SCALE 1 INCH 2' FEET

2' 0 2'



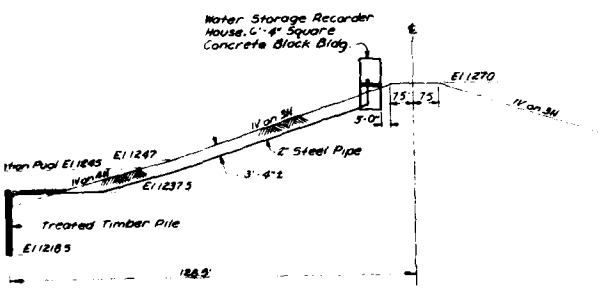
PIEZOMETER NO. 1
STA. 15+00
SCALE: VERT 1 INCH = 5 FEET
HORIZ 1 INCH = NONE FEET



PIEZOMETER NO. 2
STA. 22+50
SCALE: VERT 1 INCH = 5 FEET
HORIZ 1 INCH = NONE FEET

NOTES:

1. See Plate A21 for plots of piezometer readings.
2. See Plate A22 for water stage recorder details.
3. Piezometers installed in June of 1981.



WATER STAGE RECORDER
SCALE: 1 INCH = 2 FEET

THIS DRAWING HAS BEEN REDUCED TO THREE-EIGHTHS THE ORIGINAL SCALE.

DATE	DESCRIPTION	MADE	APPR'D
	REVISIONS		

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

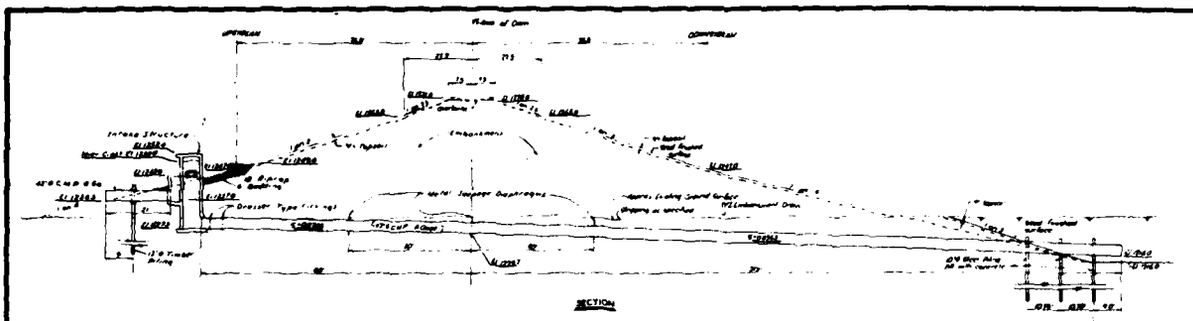
SALT CREEK AND ITS TRIBUTARIES, NEBRASKA

YANKEE HILL DAM AND LAKE SITE NO. 10
PIEZOMETER INSTALLATION AND WATER STAGE RECORDER

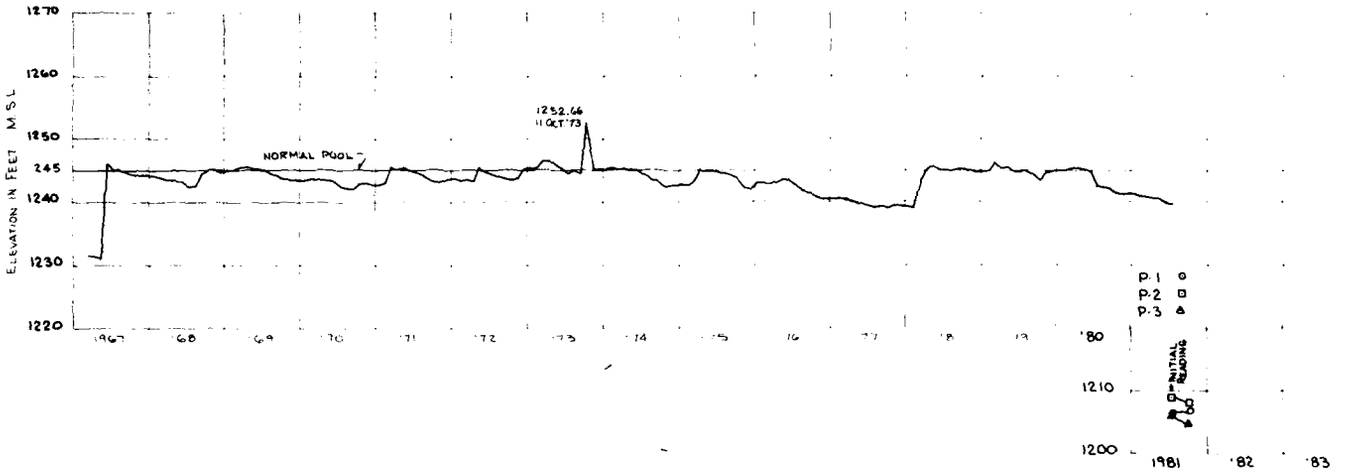
DESIGNED BY:
DRAWN BY: R.M.
CHECKED BY:
SUBMITTED BY:
DATE
SCALE AS SHOWN
DATE NO. DACA45
SHEET

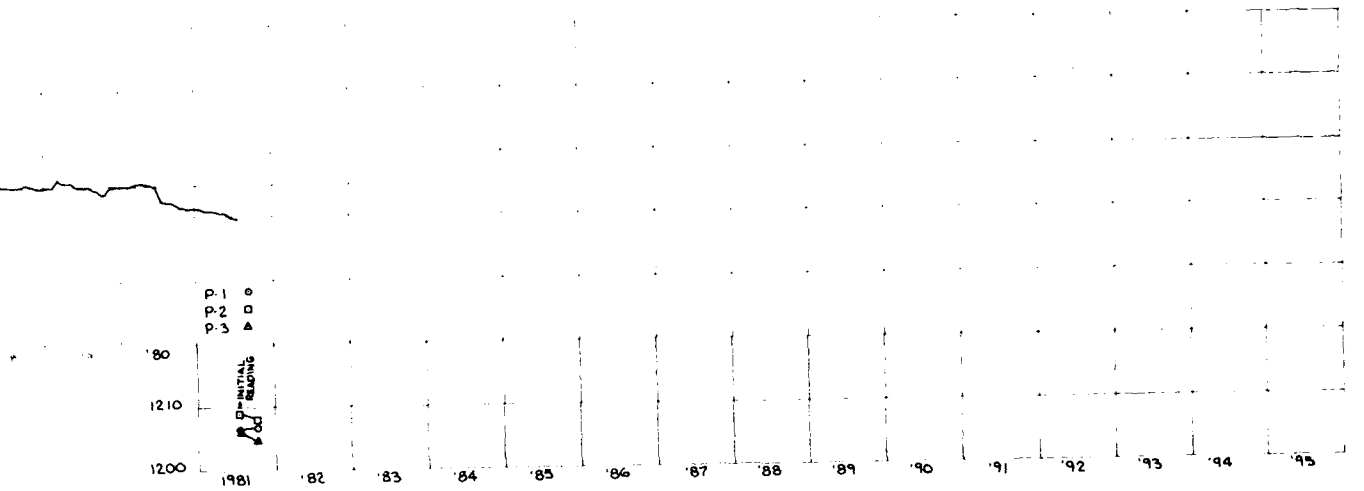
THIS PLAN ACCOMPANIES CONTRACT NO. DACA45 MODIFICATION NO.

SAFETY DAM



SECTION


ELEVATION IN FEET M.S.L.
1270
1260
1250
1240
1230
1220
NORMAL POOL
1252.66
11 OCT '73
245
1967
68
69
70
71
72
73
74
75
76
77
78
79
80
1981
82
83
P.1
P.2
P.3
INITIAL READING



THIS DRAWING HAS BEEN REDUCED TO THREE-EIGHTHS THE ORIGINAL SCALE.

DATE	DESCRIPTION	MADE	APPRVD
	REVISIONS		

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

DESIGNED BY:
DRAWN BY:
TRACED BY:
SUBMITTED BY:
CHIEF, SECTION
ENGINEER:
CHIEF, BRANCH

SALT CREEK, NEBRASKA
SITE 10
YANKEE HILL DAM
RESERVOIR ELEVATION &
PIEZOMETER OBSERVATIONS

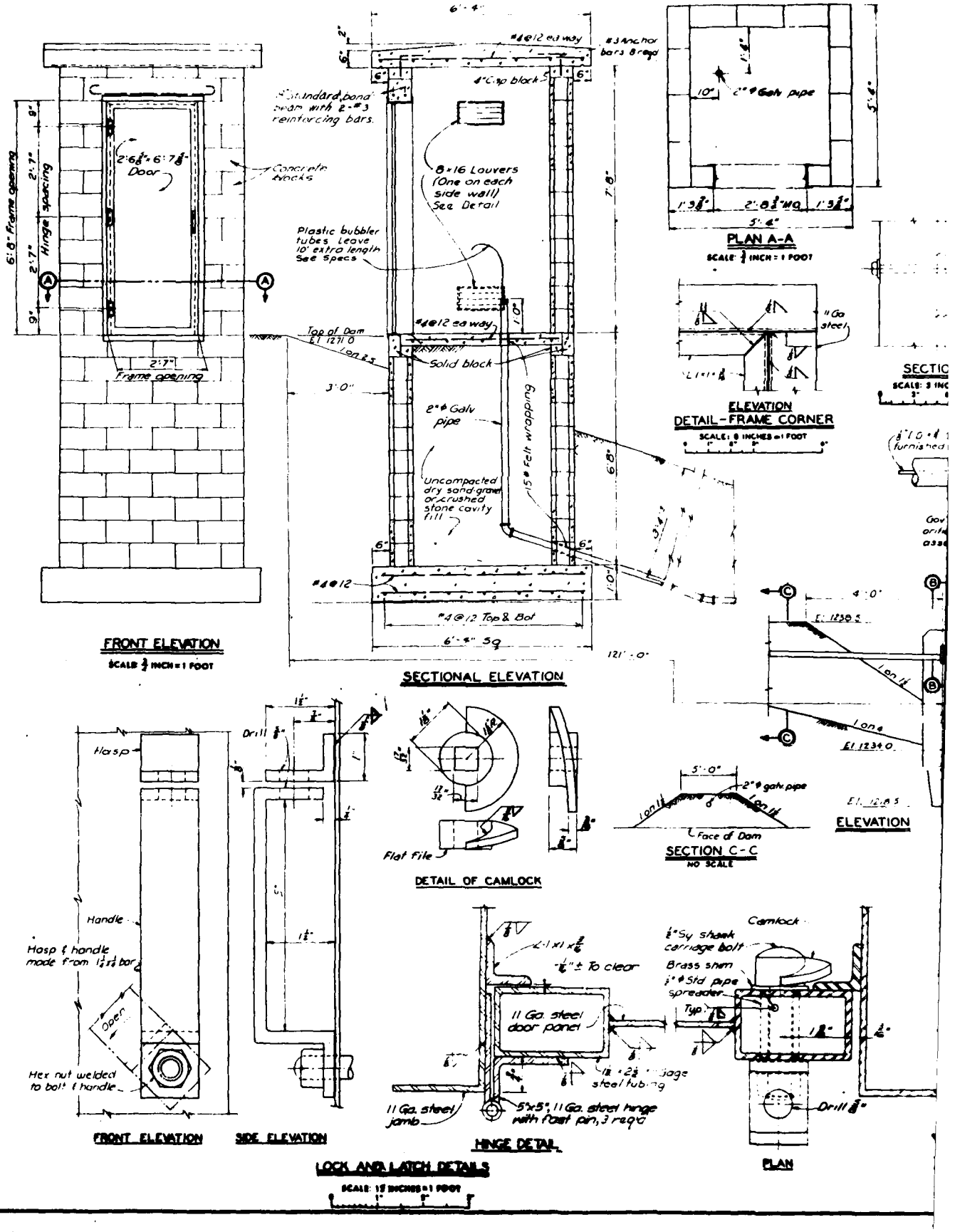
APPROVED:
CHIEF, ENGINEERING DIVISION
DATE:
SCALE: AS SHOWN
SPEC. NO.
APPROVED:
DRAWING NUMBER
COL. C. E., DISTRICT ENGINEER
SHEET

SAFETY PAYS

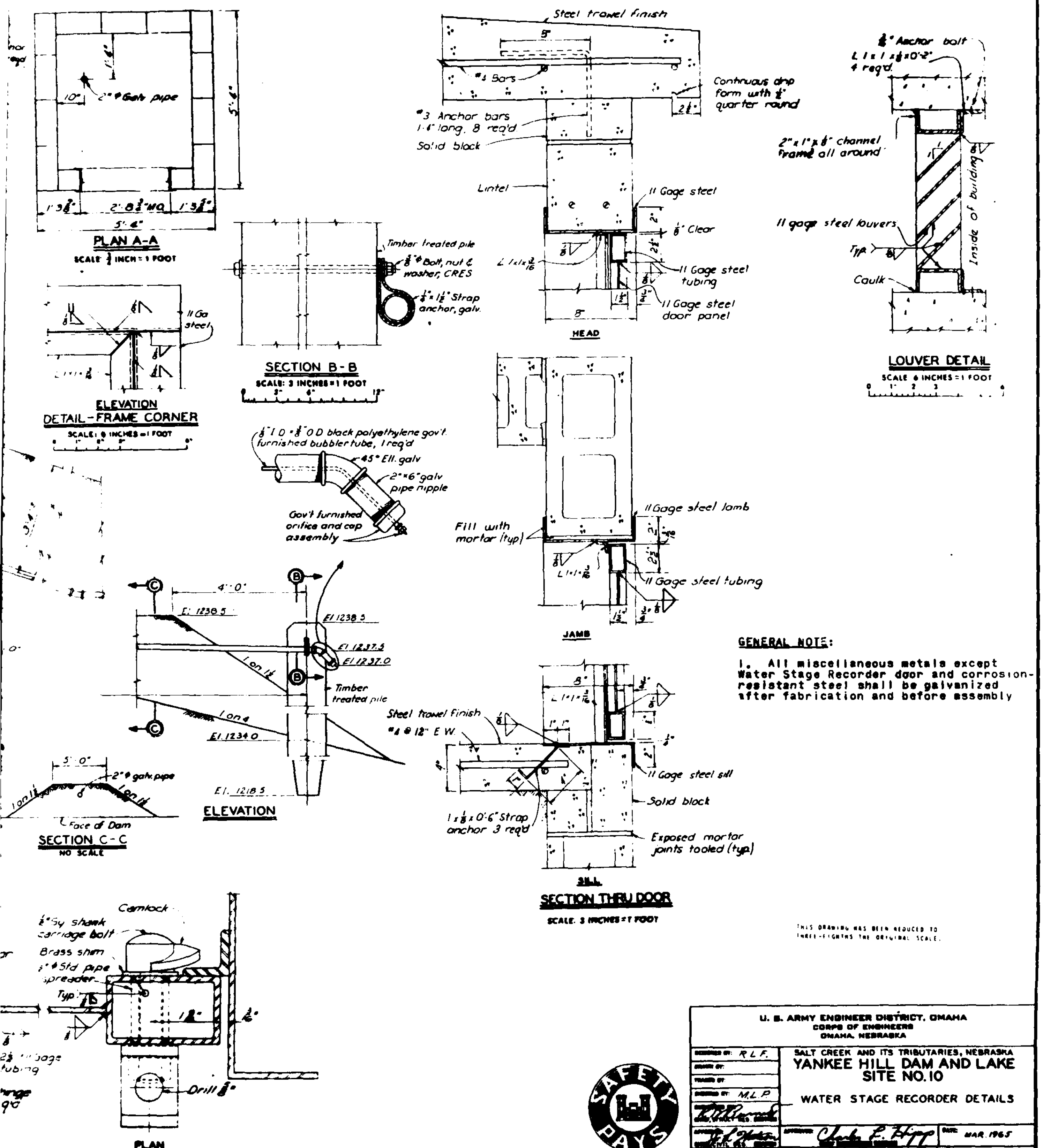
THIS PLAN ACCOMPANIES CONTRACT No.
MODIFICATION No.

EMBANKMENT CRITERIA AND PERFORMANCE REPORT (1981) PLATE A21

CORPS OF ENGINEERS



U. S. ARMY



PLAN A-A
SCALE: 1/2 INCH = 1 FOOT
2" Ø Galv. pipe
ELEVATION
DETAIL-FRAME CORNER
SCALE: 6 INCHES = 1 FOOT
SECTION B-B
SCALE: 3 INCHES = 1 FOOT
Timber treated pile
Bolt, nut & washer, CRES
Strap anchor, galv.
black polyethylene gov't. furnished bubbler tube, 1 req'd
45° Ell. galv
2" × 6" galv pipe nipple
Gov't furnished orifice and cap assembly
ELEVATION
El. 1238.5
El. 1237.5
El. 1237.0
El. 1234.0
El. 1218.5
1 on 1½
1 on 4
Timber treated pile
SECTION C-C
NO SCALE
2" Ø galv. pipe
Face of Dam
PLAN
Camlock
Brass shim
Drill
Steel trowel finish
#4 Bars
Continuous drip form with ½" quarter round
#3 Anchor bars 1'-4" long, 8 req'd
Solid block
Lintel
11 Gage steel
Clear
11 Gage steel tubing
11 Gage steel door panel
HEAD
11 Gage steel jamb
Fill with mortar (typ)
11 Gage steel tubing
JAMB
Steel trowel finish
#4 @ 12" E.W.
11 Gage steel sill
Solid block
Strap anchor 3 req'd
Exposed mortar joints tooled (typ)
SILL
SECTION THRU DOOR
SCALE: 3 INCHES = 1 FOOT
Anchor bolt
4 req'd
2" × 1" × ⅛" channel frame all around
11 gage steel louvers
Typ
Caulk
Inside of building
LOUVER DETAIL
SCALE: 6 INCHES = 1 FOOT
THIS DRAWING HAS BEEN REDUCED TO THREE-EIGHTHS THE ORIGINAL SCALE.

GENERAL NOTE:

1. All miscellaneous metals except Water Stage Recorder door and corrosion-resistant steel shall be galvanized after fabrication and before assembly

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

SALT CREEK AND ITS TRIBUTARIES, NEBRASKA
YANKEE HILL DAM AND LAKE
SITE NO. 10

WATER STAGE RECORDER DETAILS

DESIGNED BY: R.L.F.
CHECKED BY: M.L.P.
MAR. 1965

MSC II -311E 4

APPENDIX B
PHOTOGRAPHS

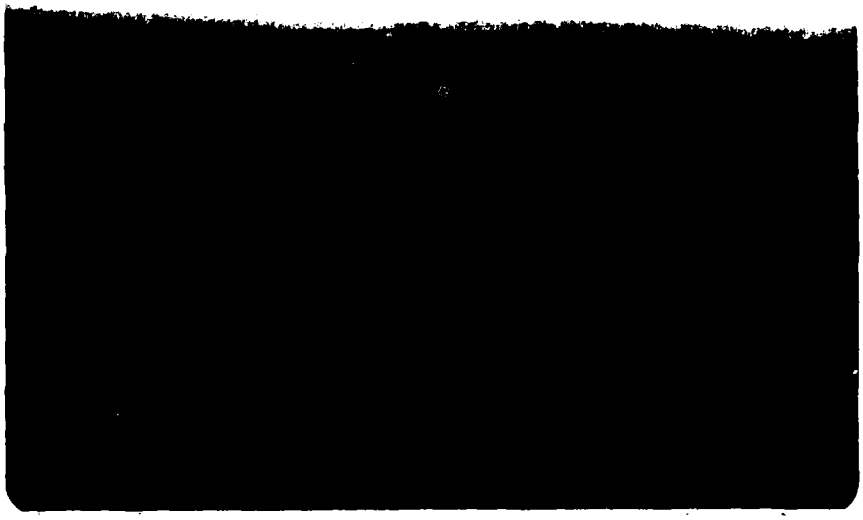


Photo No. 1a - August 1968, aerial view of project at normal operating pool level. Note the emergency spillway in the foreground of the picture.

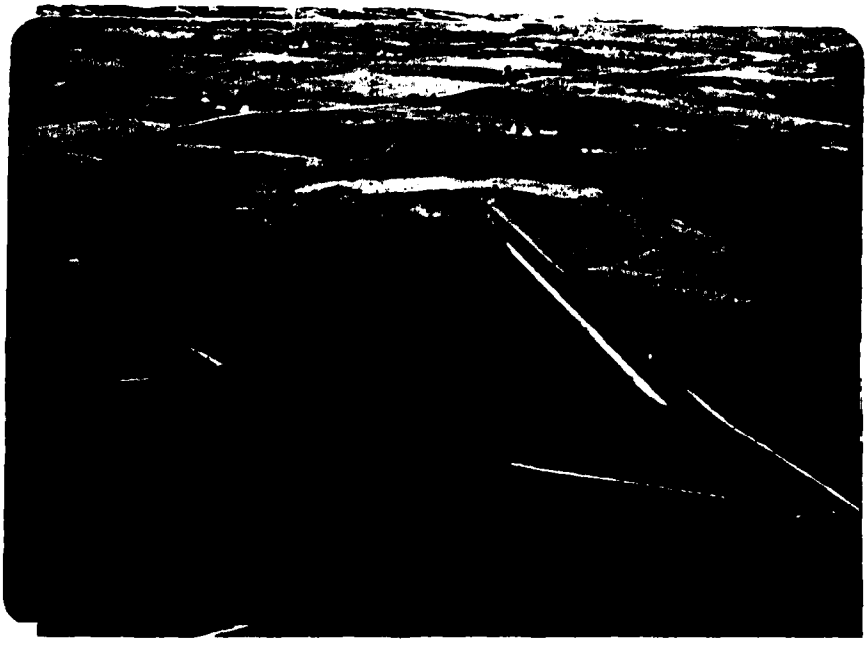


Photo No. 1b - October 1973, aerial view of project one day after record pool elevations were recorded. See note in Appendix B, PD-4.

Photo No. 2 - View of downstream embankment slope from right abutment. Normal Pool Conditions.

Photo No. 3 - View of upstream embankment slope from right abutment. Normal Pool Conditions.

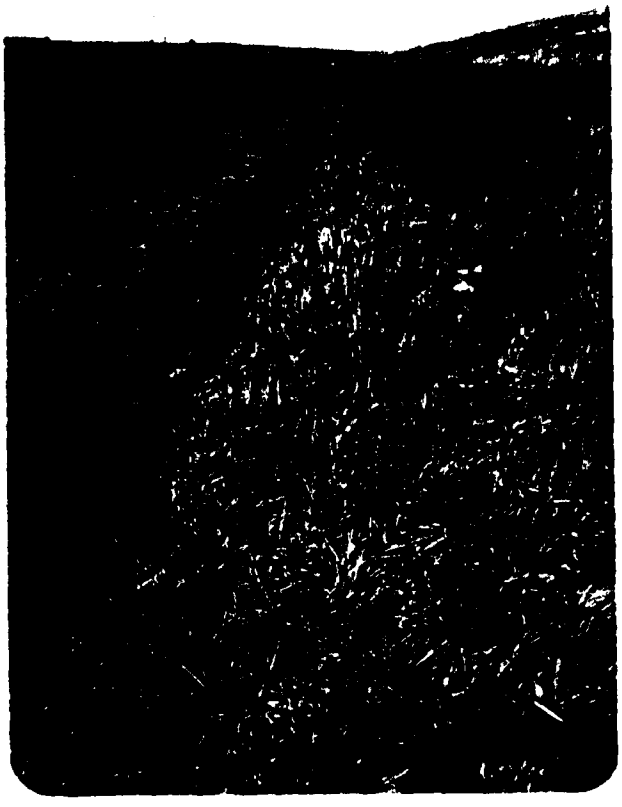


Photo No. 4 - View of upstream embankment slope from right abutment. Pool elevation is 1251.7, approximately 7.7 feet above normal operating pool.

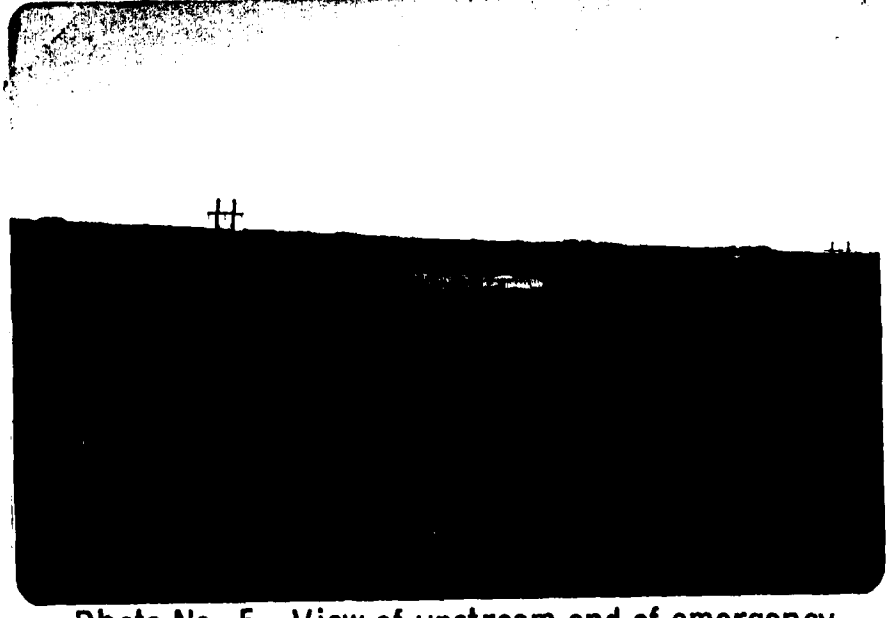


Photo No. 5 - View of upstream end of emergency spillway channel. Normal Pool Conditions.

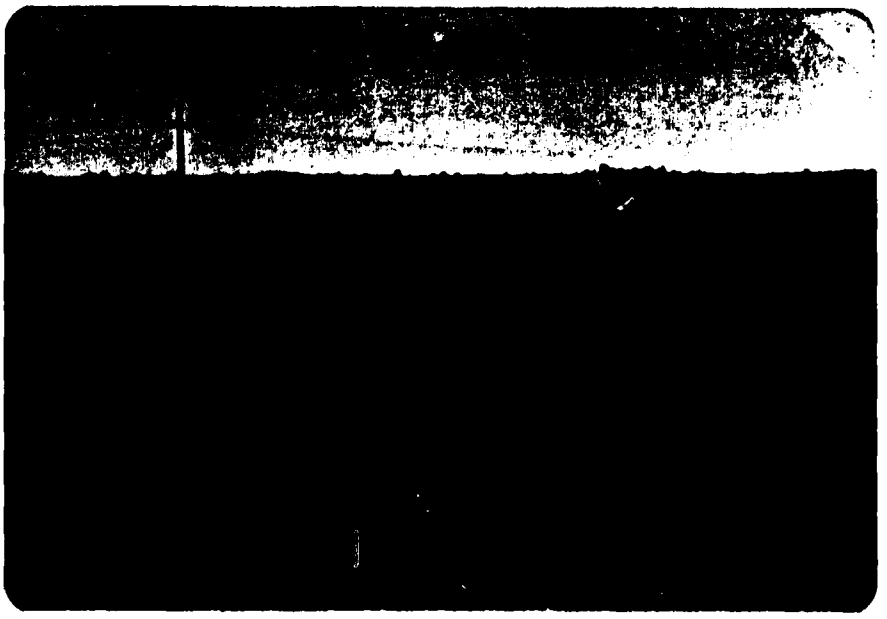


Photo No. 6 - View across spillway channel from left cut slope side. Normal Pool Conditions.

Photo No. 7 - View of embankment crest road, gage house, intake structure, and downstream slope from the southeastern end of the embankment. Normal Pool Conditions.

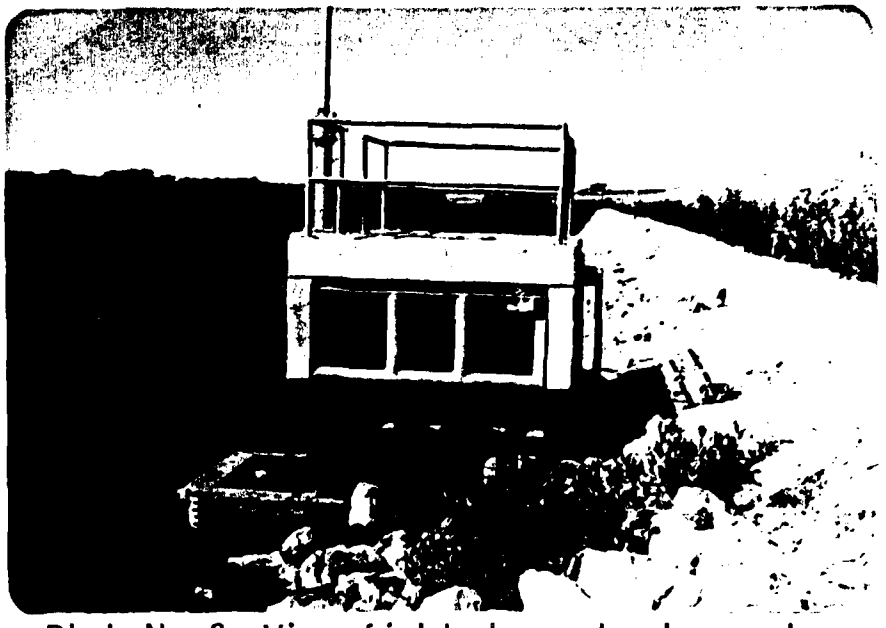


Photo No. 8 - View of intake tower structure and surrounding riprap during normal pool conditions. Note crushed rock service road along the top of the riprap.

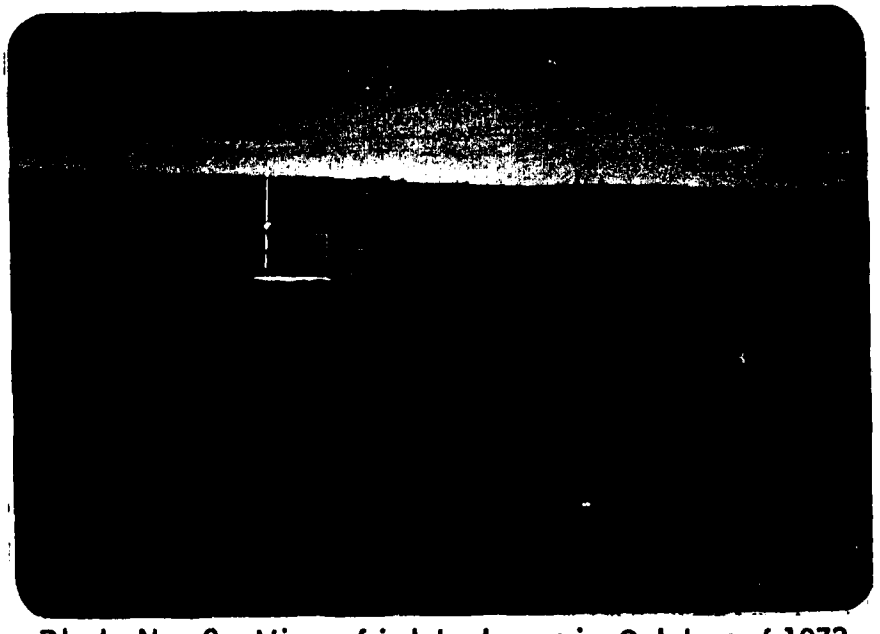


Photo No. 9 - View of intake tower in October of 1973. Pool level is approximately 7.7 feet above normal operating pool.

Photo No. 10 - View from crest of dam of outlet end of discharge conduit and downstream channel during high pool discharge. (October 1973)

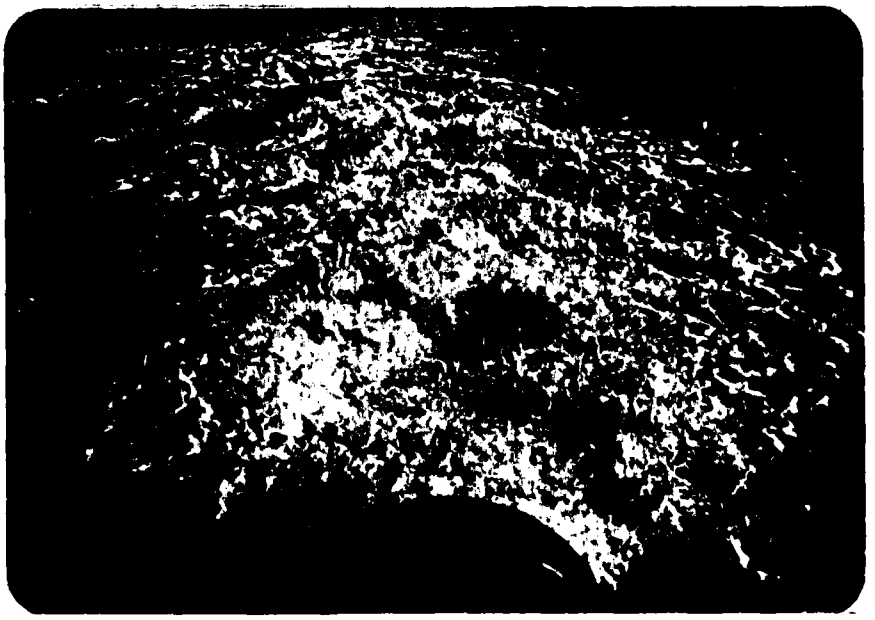


Photo No. 11 - View of outlet end of discharge conduit during high pool discharge. (October 1973)

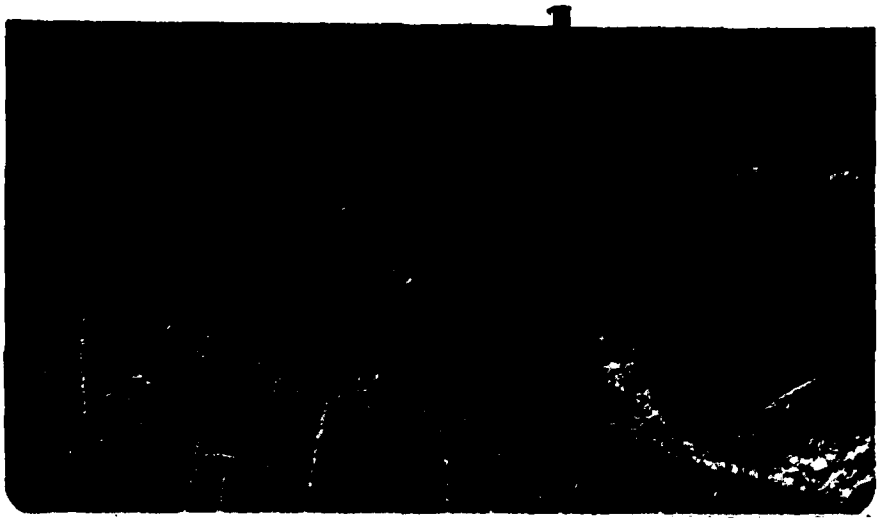


Photo No. 12 - View of outlet end of discharge conduit and plunge pool. Normal Pool Conditions.

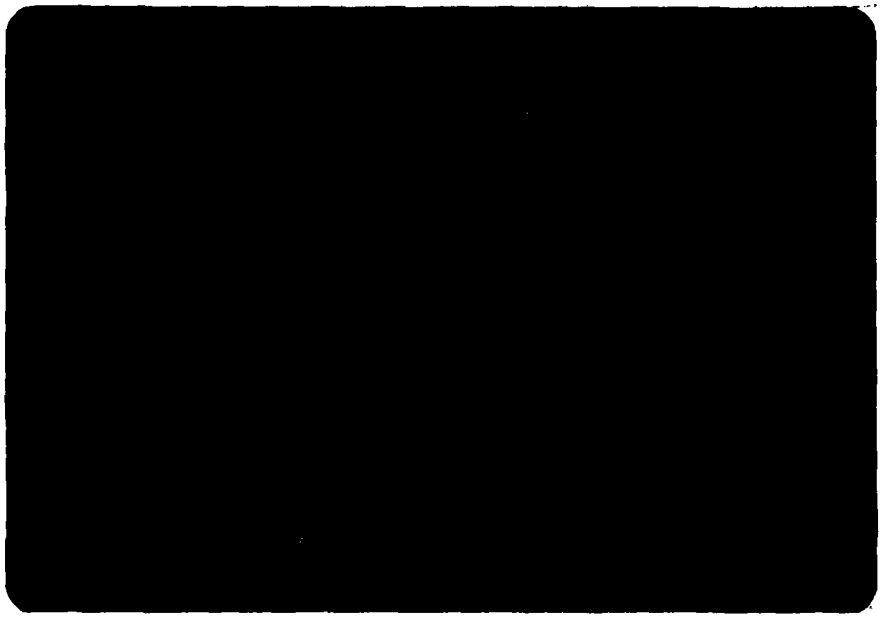
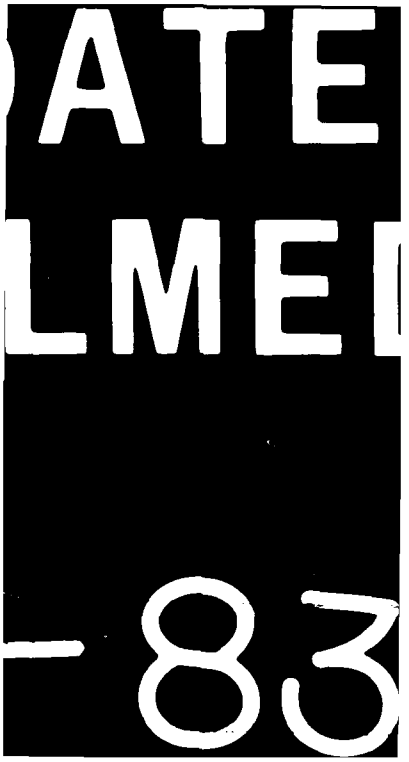


Photo No. 13 - View of upstream slope riprap protection and rock berm surfaced with crushed rock to serve as service road. Normal Pool Conditions.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